

Contractors and Engineers Monthly

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PICKS and SHOVELS

By O. E. POTTER

From One Engineer to Another

When Boulder Dam was handed over to the government, two big hard-rock men shook hands and with no more ceremony, and with the fanfare and political ballyhoo characteristic of such occasions conspicuous by its absence, one of the world's greatest engineering projects changed hands.

"Take it, it's yours," said Frank Crowe, Construction Superintendent for The Six Companies, Inc., to Reclamation Service Engineer Ralph Lowry. Then he added modestly, "It's a great dam!"

"Well, you ought to know," replied Lowry.

That's the way engineers do things.

Contrasts in Transportation

The inaugural flight of the China Clipper caught the imagination of the world. From the United States to China in five days instead of three or four weeks takes one's breath away. But the planning of this speedy means of transportation involved much more than charting a course across the Pacific, loading the Clipper ship with fuel and taking off.

A number of the problems of taking care of passengers on the China air route were described in an article in the *New York Times* of January 26. The plans for passenger service have been so well worked out and the trip itself made to seem so exciting and glamorous that, un-air-minded as we are, we were beginning to wonder if the time was coming when there would no longer be any necessity for roads, when one of the problems brought us back to earth.

At Midway Island, more than a quar-

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Wide World Photo

Part of the Stupendous Task Facing State Highway Departments to Undo the Damage of the Worst Flood Since Noah. The West River Road Near Williamsville, Vt., Covered with 12 to 18 Feet of Ice, Debris and a Subsequent Snow Storm.

All-Round Efficiency Evident on Contract for Iowa Cut-off

(Photos on page 48)

THE old order of one mile north and two miles east, then another mile north and one mile east will be a thing of the past when Iowa carries out its new scheme of diagonal roads started with the extension of State Route 88 between Des Moines and Marshalltown which cuts 19 miles off the former 65-mile trip between the two cities via the rectangular system. In the west and southwest you will find that the diagonal road is becoming more common. In Wichita, Kans., they have cut a diagonal road from the heart of the city out to the Municipal Airport which reduces the time required, at the end of a high-speed trip on a fast plane, to get into the business district.

G. G. Herrick of Des Moines, Iowa, built up a new organization for this particular job and with green men he was able to pour 852 feet of the standard 20-foot slab of 10-7-10-inch section in a 10-hour day, gradually stepping it up to an average of 950 feet. Work was started on the paving after the graded right-of-way was turned over to the contractor the preceding fall but only 20 days of paving was possible. Work was shut down throughout the winter and then started up again on the 12-mile section on April 24, 1935.

Batching Plant

The batching plant was first set up at the mid-point of the 12-mile contract and 6 miles were paved from the north-east end toward the batching plant. Then 3 miles were paved from the southwest to the plant and finally the plant moved to a point near the city limits of Des Moines and set up at the southwest end

Green Crew Well-Trained, Plant Nicely Planned to Fit Odd-Shaped Site on G. G. Herrick Job

and the last 3 miles paved toward the plant.

Crushed limestone from Winterset, Iowa, was shipped into the plant which was first located on a spur track built by the contractor. There was plenty of room at the point where the batchers were located but only a narrow roadway where it was necessary to locate the cement platform. The sand was shipped in by rail from pits in Des Moines, and the cement came from the Penn-Dixie plant. A Koehring 401 crane with a 1½-yard Blaw-Knox clamshell unloaded the aggregates and maintained a stockpile sufficient to carry the job for two full working days. The crane unloaded eleven or twelve cars of aggregate a day, moving them as necessary by attaching a steel cable to the truck of one of the cars and pulling with the crane. Three cars of cement was the usual daily tithe.

The standard batch averaged 1,806 pounds of crushed limestone, 1,251 pounds of sand, dry weight, and 643 pounds of bulk cement. The mix was designated to be 1:1.946:2.809 for maximum density with workability, based on a specific gravity of 2.65 for the sand and 2.55 for rock. Each batch was mixed the specified time of 60 seconds.

The Blaw-Knox batcher plant bins were covered with a mesh or screen of rods run through channels to keep out car flooring and rags which seemed to abound in the aggregates. A fleet of fif-

(Continued on page 14)

Counties Should Plan and Build Own Roads

Ward County, N. D., Has Added 120 Miles of Dirt Road In 3 Years Planned Economically to Meet Local Requirements

By C. A. TRUAX,
County Engineer, Ward County,
Minot, N. D.

SINCE 1933 Ward County, N. Dak., has completely changed its system of constructing roads. Prior to that time, the county used a blade grader to run down the section lines, throwing up a V-type ditch and then letting a contract to a small fresno outfit to make the necessary fills. These roads were of little use during the winter because of heavy snows and winds. The nearness of the grade line to the fields on each side prevented the provision of adequate drainage. The funds available for road work prevented the consideration of any snow removal work, and limited maintenance to dragging each road once or twice after heavy rains in the summer.

At the inception of CWA, we found that after years of spending county funds there was not one road in the county system that was suitable to gravel without reconstruction. Those in charge of county affairs in the past had felt it necessary only to appease the demand of their constituents for roads by throwing up a turnpike, and oftentimes county funds were spent on roads not in the county system. We have put a stop to this practice.

Progress in Past 3 Years

The last three years we have purchased three elevating graders and one Caterpillar diesel tractor. In that time we have cast up approximately 120 miles

(Continued on page 21)



The New Lorain Road Bridge in Cleveland Nears Completion with the Welding Operator at Work on the Guard Rails. See Page 36.

Handling Concrete for Bonneville Spillway

By HENRY W. YOUNG

(Photo on page 48)

A 2,050-foot twin radial cableway with two 8-yard buckets is transporting the concrete for the spillway at Bonneville across the river from the plant on the Washington shore to the hole. These cableways have a conveying speed of 1,200 feet per minute and average 12 trips per hour. The average concrete load including bucket and tackle is approximately 25 tons. These cableways have a lifting capacity on the hook of 40 tons. Approximately 500,000 cubic yards of concrete is to be placed in the spillway by the Columbia Construction Co., contractor for the project.

Gravel and sand are used for aggregates. About 70 miles up the river, on a bar, a solitary Marion 175 shovel is at work excavating gravel and loading direct to railroad cars. It is the same shovel that took out over 10,000,000 tons of gravel at Boulder Dam. The gravel contains some sand, and more sand is secured at a point on the river about 30 miles from the dam. Both come to the classifying and storage plant and then pass in direct line to the batching and mixing plant, an elevator-like structure at the farther end. The material is handled throughout by 30-inch Pioneer belts with Link-Belt troughing rolls. The gravel plant has a capacity of approximately 540 tons per hour.

Handling the Material

In brief outline, the material passes from car to track hopper, to belt, to scalping screen, to belt, to 6-inch screen to 3-inch + screen. Fines go to the sand screens and coarse to screens grading 1½-inch +, ¾-inch +, and ¾-inch -.

The gravel storage is in crib bins or silos. Crushing of oversize is done by a Wheeling jaw crusher and a Symons cone crusher is used where more material of a certain size is required, drawing its supply from the silos by a reclaiming belt.

In the sand plant, a Bodinson classifier is used, the product from that passing onto a belt and being distributed to the proper sand bins by a Bodinson sand tripper.

From the aggregates plant, the material passes by incline belt to the top of the batching plant. In this plant there are one sand hopper, five gravel and three cement hoppers, the cement being brought up by means of screws.

The batching in the Johnson plant is automatic and Kron scales are employed, and the water as well as the solid material is weighed. The cumulative weighing system used in this plant is the same as that at the San Francisco bridge project where it was first employed. First comes the pea gravel, then the sand, then four other sizes of gravel, all weighed and recorded approximately on a consistency chart. After being mixed in the

Big Automatic Batching Plant, 4-Yard Mixers Prepare 500,000 Yards of Concrete

four Smith 4-yard mixers, the material is dumped into a hopper and from that into two distributing or peddling cars. These cars dump directly into the hi-line buckets, which are spotted on a loading platform and are not taken off the line.

The peddling cars have a run of less than 200 feet and are third-rail-operated electric donkeys. Each car carries 16 cubic yards in two hoppers. At present they are being operated one car for each bucket, and each carrying one hopperful of 8 cubic yards. When faster operation is required, the cars will run with both compartments full, each car filling one bucket and then passing on to the next.

Loading the Buckets

The loading arrangement is an interesting one. The buckets are spotted on a trestle in the platform under which is a plank incline leading down toward a contractor's road. The bucket edges as well as the platform and trestle must be washed down almost constantly with a hose or else the spilled concrete would eventually form deposits which would hamper operations. The buckets are washed down directly through the grid onto the incline. The solid part of the platform is hosed into gutters which in



The Operator's Station for the Continuous Automatic Batching Used in the Spillway Plant at Bonneville

turn spill to the incline. The washings from the incline run onto the bank, and a bulldozer is brought around periodically and pushes the accumulated material away onto the road.

The empty concrete buckets with their tackle weigh 9 tons each. They come down swinging more or less and it is a difficult matter to spot them on the platform without banging up the piling to the rear. So a heavy steel plate about 3 feet high was fastened to the piling, and the buckets strike against this without doing any damage.

This aggregate and batching and mixing plant belongs to the Columbia Construction Co., and is under the direct supervision of C. P. Bedford, Superintendent. During the construction and the placing of this plant in operation it was under the supervision of C. P. Bedford, General Superintendent, and D. P. Williams and H. P. Davis, Assistant General Superintendents.

Highway Lighting Makes Driving Safer

Safe Lighting on Rural Highways Would Cost Only One-Third the Toll from Accidents Yearly

THERE were 12,600 traffic fatalities in 1934 on rural highways at night. That is, over one-third of all traffic fatalities—both urban and rural, day and night—occurred on rural highways at night.

Analyses made in five states show that traffic fatalities by day are decreasing slightly, but that night fatalities are increasing appallingly, according to Kirk M. Reid in a paper presented before the American Road Builders' Association. The problem is to reduce the after-dark hazard. Samplings indicate that three-quarters of the rural traffic fatalities at night occur on only 50,000 miles of highway, or less than 10 per cent of the mileage of surfaced highway. On this limited mileage the accident rate per vehicle-mile at night is 6 times that by day, and the fatality rate at night is 10 times that by day.

Experience indicates that fully one-half of night accidents on rural highways can be prevented by proper safety lighting. The use of safety lighting on the 50,000 miles of most hazardous and heavily traveled highways would save, each year, at least 5,000 lives, 50,000 personal injuries and 100,000 cases of property damage. And this would cost less than one-third the loss from the preventable accidents each year.

This opportunity for the conservation of life, limb and property has stimulated extensive researches directed to the problem of providing the most effective visibility on the highway at the lowest possible cost. Among these researches are the development of the sodium-vapor lamp which now produces almost three times as much light per watt as Mazda lamps. The results of studies on the G-E Nela Park Laboratory model highway in Cleveland have been embodied in a demonstration installation on U. S. Route 422 15 miles from the Cleveland Public Square. Each state should be gaining experience with safety-lighting installations as a means to a major reduction in traffic accidents.

The abutments were built up of four piles and a creosoted lumber cap. The piles were backed with 6 x 6 inch timber holding the creosoted lumber retaining wall and wing walls of 3 x 12's. All piles when cut off are painted with hot creosote and covered with heavy galvanized sheet iron before the creosoted cap is placed on top. A dowel pin, ¾-inch diameter and 2 feet long, is run through the metal cap and into both the pile and the cap.

An A-frame derrick of steel with a (Continued on page 16)

A Farm-to-Market Road in Western Missouri

(Photo on page 48)

NAPOLEON, Waterloo, Wellington, we read on our route when we were planning to visit a farm-to-market project about 31 miles east of Kansas City, Mo. We were a little at a loss to know whether we had suddenly shifted our map for one from continental Europe, but found that it was the Missouri map we started with and that we had hit a section that was really historically minded in naming its towns. Glad they put Waterloo between the two great Generals or there might have been trouble.

The improvement of a much-used road for the farmers of this section of Lafayette County was necessary as the soil is a river loess which is very fine, packs well but washes badly. The project underway last spring, and designated as SD-1 & 2, consisted of re-grading 9.952 miles of old roadway with about 35 per cent relocation to take out some of the worst curves, and the construction of one typical farm-to-market bridge.

10 Miles of Grading on Feeder Highway Between Napoleon and Bates City Connects Federal Routes

Grading with Blade

Practically all the work of cutting new grade and making the heavy cuts in the old grade was done with an Adams 12-foot blade grader pulled by a Caterpillar Sixty. All back-sloping and ditches were cut with this outfit while an Adams No. 10 with a Caterpillar Thirty bladed the crown and trimmed the ditches and slopes. Seven 4-foot fresnos with 2 and 3-up mule teams were used in building the farm entrances over the new 15 to 30-inch Granite City corrugated culvert pipe. All pipe was 14-gage and had 20-ounce galvanizing.

Grading was started in the late fall of 1934 but the rains that came so periodically in this section delayed the bulk of the grading until the late spring of 1935. The work progressed rapidly when the rains ceased and the contractor, Jos. L. Pohl of Nevada, Mo., could work continuously.

Typical Bridge

The bridge structure over the north fork of Sni-a-bar Creek about 4½ miles from the north end of the project is typical of the structures on farm-to-market roads in Missouri. It consists of two 24-inch I-beam approach spans of 39 feet each and a center truss 70 feet long. The two middle bents consist of ten creosoted piles each with pile caps of concrete blocks 4 feet high, 6 feet wide and 28 feet long. On the forms the contractor used Masonite inside 1-inch lumber instead of the standard 2-inch form lumber, resulting in very good appearing concrete with a minimum of rubbing.



C. & E. M. Photo
Trimming the Ditch with a No. 10 Leaning-Wheel Grader

"What we highway engineers are looking for now

is a low cost, all-weather, dependable surface
which will give a service approaching that of the
higher cost types, without excessive maintenance"

T. H. CUTLER, CHIEF ENGINEER, MISSOURI STATE HIGHWAY DEPT.



Low cost TEXACO Asphaltic surface of Road-Mix type in Shiawassee County, Mich. Constructed at a fraction of the cost of high-priced paving, this surface efficiently serves fairly heavy traffic the year around.

Addressing the American Road Builders' Convention at Cleveland last January, Mr. Cutler, one of the country's leading highway engineers, stressed the above fact.

This is not the opinion of Mr. Cutler alone, but voices the sentiment among important road engineers the country over.

The experience of the past few years, particularly, proves quite conclusively that the asphaltic types of low cost surfacing most fully answer Mr. Cutler's requirements.

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We Still Have Mud Roads

By the way some politicians talk, the average taxpayer might be led to believe that we no longer have mud roads in the United States. As soon as the frost started to come out of the ground, we began to see notices from one state after another that certain roads were closed to heavy loads, and the Associated Press under date of February 29 reported from Wildwood, N.J., that all dirt roads in Cape May County were ordered closed because weather conditions had turned the roads into morasses of mud. This order completely isolated the village of Belle Plain, which ordinarily can be reached by four dirt roads.

This is just another bit of evidence to support the demand for increased activity in the secondary and farm-to-market road fields, the service roads which connect the farm and the town.

Quoddy, The White Elephant

"Quoddy," perhaps derived from the Latin "Quod" of our famous "Quod erat demonstrandum" may not after all be quite the bonanza that the New Deal prophesied. Long before Uncle Sam started to consider the project, commercial interests had made lengthy investigations employing eminent engineers and had discarded the project as uneconomic.

Now Senator Vandenberg of Michigan reports that he has found that PWA engineers themselves and the Federal Power Commission experts had found the project unsolved and so stated in unpublished reports in Secretary Ickes' files which show:

1. It will cost more than \$30,000,000 to build, excluding transmission lines;
2. Quoddy hydro-electric power must sell for more than steam-generated power, and cannot compete with steam-generated power rates in the Boston area;
3. There is no present or prospective market for Quoddy power at any price, and
4. Hydro-electric energy

Sodium Highway Lights Aided Driver in Storm

An interesting report on the effectiveness of sodium vapor lamps for highway lighting in winter has just come to our attention. A salesman for a coal company driving through the blizzard of January 22, 1936, from Oswego, N.Y., to Syracuse, N.Y., made the following report to the General Electric Illuminating Laboratory.

"I left Oswego on my way south to Syracuse an hour after the storm started, and needed lights almost at once to get even a vague idea of where the highway might be. It became worse as I drove through Fulton, the lights of the town barely aiding a driver. After that it became a guessing game; if you guessed right you stayed on the road. Liverpool's street lights also failed to give much help. When I reached the stretch of parkway illuminated by sodium lamps, I found that vision was immensely improved by the absence of

when needed can be more cheaply generated on Maine's undeveloped rivers.

This somewhat explodes the statement of Dexter P. Cooper, designer of the Passamaquoddy project, who three days prior stated that he has arranged sale of "all the power Quoddy can produce under the present plans." Mr. Cooper's job as a special consultant on the project's administrative staff was to find a market for the tide-harnessing development's output. That output, he said, would be about 26,000,000 kilowatt hours annually.

In the meantime delightful administrative quarters have been erected near the site and that will probably be the end of Quoddy.

You Get What You Pay For

In presenting his paper on "The Modern Trend in Construction Equipment" before the Construction Section, American Society of Civil Engineers, Adolph J. Ackerman, Construction Plant Engineer of TVA, spoke feelingly of some of the trials and some of the mistakes which contractors make from the standpoint of plant when bidding on new jobs. He said:

"Some contractors shop around for second-hand equipment wherever possible, or adapt their own equipment from other jobs, thereby accumulating a plant which gives them the satisfaction of having parted with the least amount of money; others when buying new equipment drive hard bargains and demand special discounts or deferred payments which handicap the manufacturers and usually result in a cheaper standard of construction, with bronze bearings, for example, being used where high grade roller bearings would add vastly to the life and performance of the equipment, and with cheaper metals being employed where special alloys would pay for themselves many times over. In the end, the manufacturer is in business to make a profit and the purchaser will not receive any more than he pays for."

white glare on the flying snow. On that one short stretch I did not need my headlights at all, and was able to see the highway perfectly. Then I ran out of the experimental strip and proceeded immediately to pile up in a nice deep drift. Finally I got out and crept on into Syracuse. Again city lights on the outskirts of town did little to improve driving vision."

Calcium Chloride Treatments Battle Ice or Dust

The same treatment which North Dakota used this past winter to aid in the reducing danger to moving traffic on icy pavements will be used this summer to make the roads of that state dustless. A compound of calcium chloride treated gravel was prepared last fall to spread on dangerous curves and hills throughout the winter.

Now the department is planning to use calcium chloride for stabilizing soil-aggregate surfacing, and to reduce the dust nuisance this summer.

There Is No Glamor In Plain Horse Sense

In a recent issue of *Rockefeller Center Weekly*, Merle Crowell, masquerading under the initials, "M.C." thrust his rapier through the one universal vulnerable spot in our hard shells, our lack of "horse sense." We have lifted this gem bodily from the interesting pages of the *Weekly* that more may profit by its philosophy.

"Last August one of my business friends had occasion to hire a chauffeur for his big new car. Three men applied for the job at his summer home in the mountains. They were all experienced and personable.

"As a final test my friend took the trio out to a flat shelf of gravel and rock skirting a cliff with a sheer drop of two or three hundred feet. He told each applicant to drive the new car as near to the edge of the cliff as was possible with safety.

"The first man skillfully skirted the very edge of the cliff. The second managed miraculously to get a couple of inches farther out. 'Now it's your turn,' my friend said to the third applicant.

"Thank you, sir, but you couldn't hire me to drive that fine car so close to a dangerous drop," the man replied.

"You get the job," said my friend. 'I can hire lots of men to take chances, but common sense is still hard to find.'

"Business men agree that it is easier to buy talent than it is to buy judgment. And the same thing holds true in every other walk of life.

"There's a fortune—a large one—waiting for the man who can make plain horse sense popular and palatable.

"Tell the average human being to eat less, walk four miles a day, and breathe more deeply. He will yawn in your face. Tell him that some savant has discovered a magic cure-all and he'll prick up his ears with pathetic promptness.

"Remark to a friend that the best road to happiness, here and hereafter, lies along the time-worn path of the Golden Rule and the Ten Commandments. He will register a complete lack of interest. Mention some new cult that promises the latest thing in passages to the Pearly Gates. He will travel twenty miles to hear about it.

"Try to convince the fellow who works alongside you that honesty, energy, and common sense will take him inevitably from where he is to where he may reasonably expect to be. He'll bat your copybook maxim right back at you. Suggest that he might make his fortune by investing in some marvelous new promotion scheme. Immediately he will be all agog.

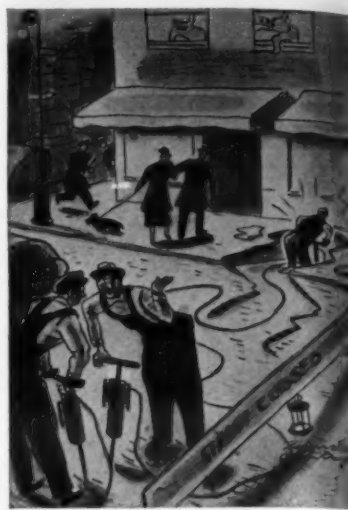
"We go about with our eyes and ears half shut, trying out short cuts to health, wealth, and happiness, pursuing panaceas prettily dolled up, and following new-fangled fluddubberies which offer to our gullible minds ease, happiness, or salvation without a struggle.

"The elimination of waste is one of the shibboleths of scientific management. But in the whole wide world there is no waste so great as the waste of experience—the experience of others who have met the human problems we have to meet and have left records of how they handled them.

"Usually we refuse to get the general body of our experiences vicariously. Each of us blunders along, learning the lessons of life all over, making the same mistakes that men have made before us and told us about in no uncertain terms.

"So far as we are concerned, the sages of all the ages might as well never have lived and suffered and learned and passed on to us their precious legacies of wisdom.

"In the fields of history, biography, and the manifold branches of science



Courtesy of Rockefeller Center Weekly and Thorton Gentry

"Jim's Getting Very Absent-Minded These Days"

Bauer's "Plain Concrete" Now in Second Edition

Prepared primarily as a textbook for undergraduate engineering courses in plain concrete, Professor Edward E. Bauer of the University of Illinois, in 1928, brought out the first edition of "Plain Concrete." The many developments in the field of concrete since this first edition have led to the rewriting of most of the material and the addition of many illustrations for the second edition just published.

The chapter on special cements has been enlarged, the theories of proportioning are presented in a separate chapter, the chapter on estimating has been rewritten and incorporated as a chapter on applied proportioning, and in the chapter on factors affecting concrete strengths new curves for present-day cements have been given for the age-strength relationship for sand and cement and a special cement.

Other revisions have greatly enhanced the worth of this valuable book published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York City, price, \$4.00.

Diesel Engineering

The increasing use of diesel engines will require an increasing number of men conversant with the principles and practice of diesel engineering. To help prepare men to enter this field of employment, a new book "Elements of Diesel Engineering" by Orville Adams, Consulting Diesel Engineer, has just been published.

The book covers all the essential operating principles and maintenance engineering, is written in non-technical language for every man in the production and service end of the industry as well as for operators, repairmen, contractors and engineers in the field.

Copies of this publication may be secured from the Norman W. Henley Publishing Co., 2-4 and 6 West 45th St., New York City. Price: \$4.00.

and industry, we give an almost sacred importance to the printed word. Any qualified expert has our unqualified attention. But in the simple art of living we prefer to manufacture our own rules on our own premises. Libraries may be spilling over with accumulated wisdom and the printing presses may be grinding out fresh crops, but each man thinks that his own problems are personal and peculiar.

"So we plunge ahead, tumbling into immemorial pitfalls, tripping over the same hurdles that tripped the faltering feet of the race from the dawn of time. And it's all because the time-tested rules of life are so obvious that we see no glamor in them."

Made-to-Order Plant Furnishes Hot-Mix

IN THE northwest section of Columbus, Ohio, B. F. Patterson, paving contractor, has set up a hot-mix plant that has in it the units which in his experience he has found to be most satisfactory for that service. He takes contracts up to 50 miles from Columbus and without trepidation mixes the batches and sends them out by truck to the job, secure in the knowledge that they will meet every specification of mix and temperature when they reach the road.

Aggregate Handling

Both sand and the coarse aggregate are purchased from the Marble Cliff Quarries Co., of Columbus, and the materials are trucked into the plant and dumped. The coarse aggregate is delivered through a grizzly into a pit from which it is picked up by a Columbus bucket elevator and delivered to a concrete silo 20 feet in diameter and 42 feet high and with a 6-inch concrete roof. At the bottom of the silo there is a grid of two 15-inch pipes through the middle and 8 and 10-inch laterals with holes in them for steam or air to dry out aggregates that are frozen or wet. The material runs by gravity to a bucket elevator which takes it to the drier.

On the opposite side of the drier is the sand storage with another bucket elevator which feeds both sand and No. 9 limestone for the top mix to the drier. The sand is brought in by truck and tipped into a 1,500-ton capacity pit and handled with a General Excavator crane and 1/2-yard Owen clamshell bucket to the hopper of the Columbus reciprocating feeder for the drier. The plant is located on a spur track, making it possible to receive lake sand for sheet asphalt top by rail.

The drier is 24 feet long and 5 feet 6 inches in diameter and is heated from the delivery end by two Hauck burners which maintain a temperature of about 400 degrees in the drier at the hot end. The dry material is carried to the top of the screen house where it is separated by a 4-deck Plato vibrating screen made by Deister. Thence the material goes to its respective bins for storage till drawn by the weigh man.

Gravity Feed for Asphalt

The asphalt for the plant is received in tank cars from the refinery of the Standard Oil Co. of Ohio and pumped with steam-jacketed Kinney asphalt pumps to three 40-ton storage tanks at ground level. Then with the same pumps it is raised to four elevated storage tanks of 10 tons capacity each and run by gravity to the weigh box of the plant. The asphalt is agitated with air in the elevated storage tanks and when the material is low the air valve is set for 4 pounds pressure and that pressure of air in the tanks forces the asphalt rapidly enough for the operation of the plant.

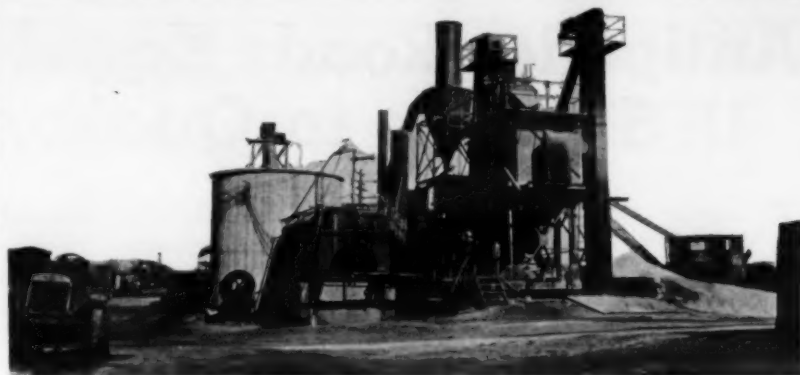
Both the aggregate weighing batchers and the asphalt weigh bucket are equipped with Fairbanks dial scales for ready visual checking of the weights. The asphalt weigh bucket is a Hetherington & Berner non-tilting, steam-

B. F. Patterson Selected Units Best Suited for His Work for Hot-Mix Plant in Columbus, Ohio

jacketed bucket with 10 holes and nipples for delivering the asphalt to the mixer.

Mixing the Batch

The pug mill mixes the aggregates 15 seconds dry, and 45 seconds with the asphalt. Careful examination of the mix has shown that 100 per cent of the aggregates in the mix is coated with asphalt at the end of the mixing time. The specified mixing temperature is 275 to 375 degrees Fahrenheit, and the batches are sent out to the road at 315 to 325 degrees. Five men are required



C. & E. M. Photo

B. F. Patterson's Base of Operations in Columbus, Ohio

to run the plant.

As the insulated trucks come into the plant for their batches they stop at a spray stand and coat the inside of the bodies with an emulsion of fuel oil and water sprayed from a nozzle with air pressure. After receiving their loads the batches are covered with tarpaulin to conserve the heat as far as possible

for the long hauls to the job.

Personnel

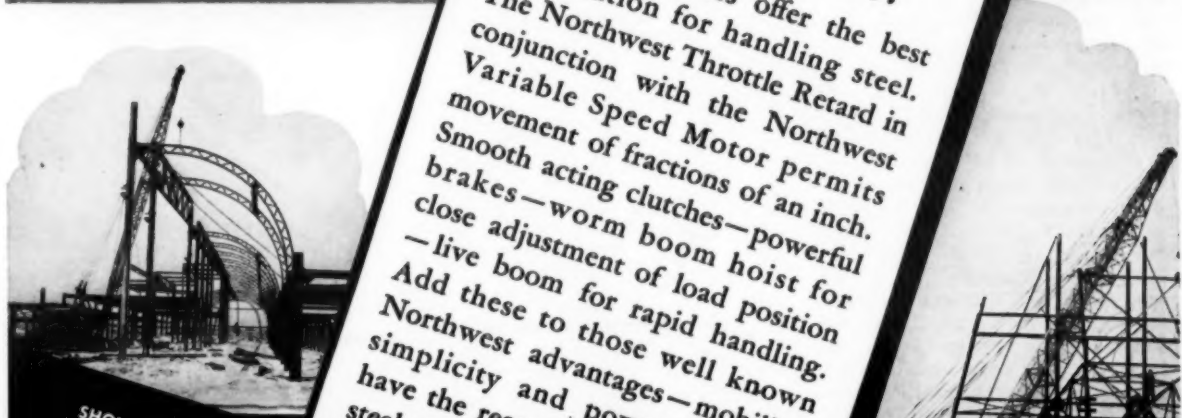
This plant is located at the yard of B. F. Patterson where his office and garage are situated, 999 West Goodale Street, Columbus. It is operated under the direction of the Plant Superintendent, Harold G. Dennison.

STEEL ERECTORS!



Here are the Crane
Features You Need for
Precision Control!

Northwest Cranes offer the best combination for handling steel. The Northwest Throttle Retard in conjunction with the Northwest Variable Speed Motor permits movement of fractions of an inch. Smooth acting clutches—powerful brakes—worm boom hoist for close adjustment of load position—live boom for rapid handling. Add these to those well known Northwest advantages—mobility, simplicity and power and you have the reasons why the leading steel erectors are using them.



SHOVELS, CRANES
DRAGLINES
PULLSHOVELS
SKIMMERS

BUILT IN A RANGE OF 15 SIZES — 3/8 YD. CAPACITY AND LARGER

NORTHWEST ENGINEERING CO.
1730 Steger Bldg. 28 E. Jackson Blvd.
Chicago, Illinois, U. S. A.

GASOLINE, OIL
DIESEL OR
ELECTRIC
POWERED

Hot-Mix, with All Limestone Aggregate

Base and Leveling Course		
No. 3A stone (1 1/2-inch to 3/4-inch)	35	per cent
No. 4 stone (1-inch to 3/4-inch)	35	per cent
Sand	24.5	per cent
50-60 penetration asphalt	5.5	per cent
Blinder Course		
No. 4 stone (1-inch to 3/4-inch)	66.9	per cent
Sand	27.8	per cent
50-60 penetration asphalt	6.3	per cent
Type C Top Course		
No. 9c stone (3/4-inch to 3/8-inch)	50.0	per cent
Sand	41.8	per cent
50-60 penetration asphalt	8.35	per cent

Antipodes Roads Equal U. S. Roads in Quality

TO most people living on the continent of North America, Australia, New Zealand and Oceania "down under" seem to be on another planet and the realization that they have met the same type of road problems as ours and in many cases with equal success is startling.

With an area only slightly smaller than the United States, and a population of only about 6,500,000, Australia has developed a very fine road system, comparable to that of the United States. The percentage of paved and unpaved roads is about equal to that in this country, about the same number of types of construction is in use and most of the paved and surface-treated types of roads are the result of using standards and specifications developed in the United States.

The total mileage of highways in Australia is about 471,640, divided as follows: New South Wales, 120,115 miles; Victoria, 106,335 miles; South Australia, 50,566 miles; Western Australia, 64,098 miles; Queensland, 117,840 miles; and Tasmania, 12,687 miles.

The construction and maintenance of the roads are generally carried out by Main Roads Boards and local authorities of the respective states. Each state has a Main Roads Board, which is responsible for construction financed from Government funds. The greater portion of the funds is supplied by revenue obtained by the states themselves. There are numerous shire and municipal councils in each of the states which carry out road programs from their own funds, procured mainly from property rates. In addition, in the greater proportion of total expenditures on roads under the Main Roads Boards, jurisdiction is placed under the supervision of the local municipal councils.

Under the Federal Aid Roads Act for the fiscal year 1934-35, grants of Federal Aid to the states amounted to £2,465,980 (the average rate of exchange for the Australian pound in 1934 was \$4.00 and for 1935 \$3.88) and for the fiscal year 1935-36 the estimated Federal Aid grants were £2,500,000. During 1934-35 the revenue derived from motor vehicle registration fees and drivers' licenses amounted to £5,023,814, most of which was spent on road building. The funds for Federal Aid distribution are obtained from customs duty on imported gasoline and an excise tax on gasoline manufactured in Australia.

The agreement on Federal Aid between the Commonwealth Government and the respective states was based on the estimate of approximately £2,000,000 a year but for the past two or three years the amounts distributed have exceeded that estimate, due to increased receipts from the gasoline imposts. The present agreement expires in 1936 and it is expected that at that time the Commonwealth will reduce its annual Federal Aid to the original amount, £2,000,000.

The funds provided by the state government for road construction and maintenance are mainly from motor vehicle registration fees and parliamentary appropriations, either from revenue or loans. Money is collected also from land owners by shire and municipal councils, for road purposes, through the levy on the unimproved value of land.

Cement, stone, gravel, sand, tar and bituminous substitutes are produced locally, the only road material imported at the present time being asphalt. Road equipment is manufactured in Australia by several large firms which furnish most of such equipment needed, so that very little road equipment is imported.

Australia, New Zealand Have Excellent Highways; Other Islands Have Roads to Meet Local Needs

Progress during 1935

During the year which ended June 30, 1935, Western Australia cleared 848 miles of road, graded 807 miles, gravelled 339 miles, metalled 15 miles, sanded 10 miles, reconditioned 173 miles and constructed 213 miles of side drains. A total of 95 miles of road received bituminous treatment.

The Main Roads Board of Western Australia goes on the basis that the best and cheapest method to insure adequate maintenance of constructed sections of

roads, whether surfaced with gravel, metal or bitumen, is by the use of the regular patrol system.

The work carried out on unconstructed sections of the main roads consisted of such improvements as the available funds would permit in keeping the roads open to traffic throughout all seasons. On the constructed sections of the main roads, the work consisted of improving and keeping drainage clear by surface dragging in the case of gravel roads and by giving attention to the surfaces of bituminous pavements. The operations over the 2,825 miles of declared main roads cost an average of £20 a mile, as reported in *Roads and Road Construction*.

During the year, 36 bridges of an aggregate length of 2,759 linear feet were constructed of timber and 42 masonry and timber structures, of a total length of 1,004 linear feet, were erected. In addition many culverts were installed.

Mixed-in-place or road-mix construction, using the gravels native to the region, was extended. The gravel was



Australian Government Photo

A Country Road in Victoria, Australia.

sprayed in place with a fluxed bitumen binder, the binder and gravel being thoroughly mixed.

(Continued on page 22)

The Koehring Wheel Dumptor for hauling · dumping · spreading

Full vision for the Koehring Dumptor operator means fast loading, quick getaway, spot dumping and spreading. He has complete eye control of all operations from the driving position . . . the load is always ahead of the operator . . . for quick and easy spotting at the loading unit and instantaneous dumping . . . seconds saved in every operation by eliminating all unnecessary moves.



FULL VISION for SPEED



The load is instantaneously dumped by force of gravity, without time-losing mechanical complications.



KOEHRING COMPANY
Pavers · Mixers · Shovels · Cranes · Draglines · Dumptors · Mud-Jacks
3026 WEST CONCORDIA AVENUE, MILWAUKEE, WISCONSIN

Highway Construction Affects Other Business

The improved highway is a product of manufacture, and highway construction is therefore essentially a manufacturing industry. It is, moreover, a very important industry, for during the years 1926 to 1933, according to T. Warren Allen, Chief, Division of Management, U.S. Bureau of Public Roads, the average annual expenditure for highway construction purposes by Federal, state, county and city governments amounted to approximately \$1,350,000,000. This formed more than 50 per cent of the total average annual public construction bill for those years. How this highway construction activity has affected other lines of business and industry may be better realized when it is understood that as a result of the single item of Federal appropriations for highway improvement and since its beginning, about two-thirds of a billion dollars has gone into highway contractors' equipment ownership and operating expense, and another billion and a third into materials of construction.

For the expenditure of each \$100,000,000 of the annual highway construction program of the last few years, about 43,000,000 cubic yards of excavation have been moved, 15,000,000 square yards of pavement have been laid, 100 miles of galvanized culvert pipe have been put in place, and 43,000,000 pounds of reinforcing steel and 17,000,000 pounds of structural steel have been utilized in pavements, bridges, and minor structures.

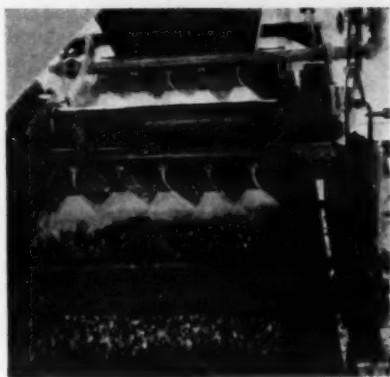
New Splint for First-Aid

A man with a broken leg is always difficult to handle. He is powerless to help himself, and he cannot be moved without great suffering and, possibly, further injury, unless the fractured limb is properly braced and supported. An improved type of leg splint, known as the Greene Traction Splint, has been announced by the Davis Emergency Equipment Co., Inc., 55 Van Dam St., New York, to enable first-aid workers to take care of such cases easily and effectively.

The longitudinal members of the splint are made of wood, which is preferred to steel because X-rays of the leg can be taken without removing the splint. The upper end of the splint is formed by a half ring of laminated wood, reversible for either leg, and the lower end by a cross-piece of metal in which is mounted a hook which can be drawn forward by turning a wing nut.

With the half ring lying flat, the splint can be put in position with minimum movement of the injured leg. The half ring is fitted around the thigh, its design being such that it does not cut off circulation, and the leg is tied to the sides of the splint by triangular bandages at the thigh and the ankle. The ankle bandage is then connected to the hook in the cross piece by a strong cord, and traction is applied to the leg by means of the wing nut. Four more supporting bandages, two above and two below the knee, are then put on, and more traction is applied as needed. Finally, the splint is raised and a metal foot rest is attached to the cross piece, which insures a comfortable position for the injured leg. The subject can now be carried on a stretcher, or even in men's arms, and transported in a car without discomfort.

The Greene splint weighs only 7½ pounds complete and can be compactly packed in a flat case. Wooden parts are of the best quality birch, and metal parts of a non-rusting alloy. A few minutes training will enable any intelligent man to apply it properly. It was developed by Harold Greene, of the



Chain Belt Spray Nozzles Washing Gravel on a Shaker Screen

Aetna Life Insurance Co., with the co-operation of Dr. Harry Archer, Chief Surgeon of the New York Fire Department, and Dr. Robert H. Kennedy, of the American College of Surgeons.

Non-Clogging Spray Nozzle For Washing Aggregate

A nozzle designed to produce a flat, fan-shaped spray insuring complete coverage for the washing of aggregate is manufactured in three sizes by the Chain Belt Co., 1666 West Bruce St., Milwaukee, Wis. These Rex non-clogging flat spray nozzles are made for 1, ¾ and 3/8-inch pipe threads with 9/16, 11/32 and 1/8-inch standard throat openings respectively. The materials used are Rex Z-metal, Tobin bronze, aluminum bronze, stainless steel, alloyed steel, etc. to suit the various conditions encountered in different installations.

The high velocity spray from this nozzle is concentrated on a thin flat line of impact with a resulting cutting action which produces better cleaning and requires less volume of water per unit area of coverage. The tapered inlet and round orifice of the Rex spray

nozzle will pass foreign material of approximately the size of the orifice, preventing clogging.

These nozzles are used extensively for washing crushed stone, silica sand, for removing debris from traveling water screens and many industrial and commercial services.

A descriptive folder has been issued by the manufacturer who will be glad to send copies on request.

GRIFFIN WELLPOINT SYSTEMS

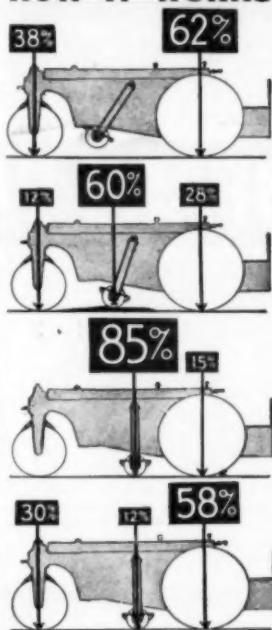
Have Dried Quicksand Jobs in 24 Hours
Exclusive Patented Money-Saving Features
Prove Their Value in Final Costs
Job layouts and estimates furnished
Send for Catalog A

GRIFFIN WELLPOINT CORP.
60 East 42nd Street, New York, N. Y.
Phone Murray Hill 2-3238

Roll-A-Plane

A MACHINE THAT IS REVOLUTIONIZING ROAD ROLLING METHODS

HOW IT WORKS



● Experience during the past two years shows that the use of the Roll-A-Plane for bituminous materials results in a finished surface varying less than one-eighth of an inch under a 10-foot straight edge.

Here are the reasons: As shown above, the machine first goes on the job as a conventional roller to get compaction. Then the center roller is immediately dropped into position and the wavy surface developed by the usual rolling action is ironed out.

While the binder is still in a plastic condition, the center roller finds the high spots and by a tremendous spot pressure, it forces the excess of material into the nearby voids. The high spots are removed; the material relocated where it is most needed—and

because the binder has not had time to harden it will reseat to form a close bond of even density.

This closer compaction and the even surface of the finished job, are all accomplished at a saving of from 30% to 50% of the time formerly required, since all cross rolling is eliminated.

More and more states are writing specifications which call for closer tolerances on asphalt highways. Write for your copy of "The Roll-A-Plane Process." It explains the use of these machines from base course to wearing surface. Your name and address will bring it to you without cost or obligation.

WHY IT'S BETTER

SAVES 30-50% TIME

NO CROSS ROLLING

COMPACTS HOT MIX BEFORE SETTING

RESULT-DENSE SMOOTH SURFACE

Austin-Western

ROAD GRADERS • MOTOR GRADERS • ELEVATING GRADERS • DRAGS
ROAD ROLLERS • DUMP WAGONS • DUMP CARS
SCARIFIERS • BULLDOZERS • TRAILERS • SCRAPERS • PLOWS
BITUMINOUS DISTRIBUTORS • ROAD-MIX MACHINES • CULVERTS
CRUSHING AND WASHING PLANTS • SWEEPERS AND SPRINKLERS • SHOVELS • CRANES • ETC. • SNOW PLOWS

The Austin-Western Road Machinery Co.
Y. Aurora, Illinois
Please send me free copy of "The Roll-A-Plane Process."

Name.....615-C
Address.....
City.....State.....



Making Better Roads With Sand and Clay

The Use of Bituminous Binders and Portland Cement for Stabilization of Low Cost Roads

By F. C. LANG

Engineer of Tests, Inspection and Research, Minnesota Department of Highways

THE widespread attention being given to stabilization of soil and gravel roads today is due to the greater need for better low-cost roads, the recent advances in our knowledge of the behavior of soil, and the activities of some commercial interests.

Bituminous Binder for Sandy Soils

Soils may be divided roughly in sandy soils, which are notoriously bad in dry weather, and clay soils which are entirely unsatisfactory in wet weather. Sandy soils are deficient in cohesion. To provide this cohesion, bituminous materials and clay are added as binders. One of the outstanding examples of the use of bituminous materials as binders is the sand-bituminous road mixes in Florida. From 3.5 to 5 gallons of bituminous material is used per square yard. The road is treated to a depth of approximately 6 inches. Either cut-back asphalt or refined tar is used. The amount of bituminous material used is determined in the laboratory and changed when necessary in the field. The sand is used as it occurs in the road and may or may not be well graded. The mixing is done on the road, using plows, disc harrows, blades and retread mixers. After spreading the mixture, it is compacted with rollers. The average cost of 255 miles is reported as 41 cents per square yard.

The binding of loose sand with bituminous material has been done in other places in the United States by various methods, and with various amounts of bituminous materials with different degrees of success. It seems to be necessary to have a considerable thickness of the treated mat. Otherwise the traffic will either break through the bituminous material or deflect it so that it will become rutty due to the lateral displacement of the underlying sand. The rounder the sand particles and the poorer the grading, the more danger there is that this will occur.

Clay Binders for Sand

The other binder used on sand is clay. Road builders have realized for years that a mixture of sand and clay would produce a better road than either material alone. It was the practice to build such roads by rule of thumb methods and the results were naturally quite variable. In order to obtain the best results with sand-clay mixtures, the sand must be well graded from coarse to fine. The clay-binder must be spread as a very thin film on the individual sand grains.

It is impossible to get the binder film too thin as long as it completely covers the aggregate.

The sand-clay mixture is the mortar which holds the pebbles in place in the gravel roads. It is generally considered that the maximum size of the sand particles in a sand-clay road is 0.1-inch. The pebbles in a gravel road, larger than 0.1-inch, may be considered as coarse aggregate.

Stabilizing Clay Soils

The clay-type soils may be stabilized in three ways: (1) Adding granular material, such as sand, to provide internal friction which amounts to the construction of a sand-clay surface. On clay roads, a large amount of sand is required as the clay portion should constitute only about 15 per cent of the total mixture. In many areas, it is not economical or even possible to obtain enough sand for this purpose. (2) Treating the soil so that water cannot enter it in sufficient

amount to soften it. The method of doing this with emulsified asphalt has been investigated by commercial companies in California and also by the California Division of Highways. T. E. Stanton, Materials and Research Engineer of the California Highway Department, reports that the effectiveness of this treatment is evidenced by compressed samples remaining hard and firm and showing no swell upon immersion in water. While all soils do not respond uniformly to this treatment, there is in most cases a very definite improvement. The manufacturer of the emulsion used in California recommends that enough water be used with the emulsion to bring the soil above the plastic limit. This involves equipment as well as construction and traffic problems. When the treated soil dries, it appears that the soil particles are so glued together by a thin asphaltic film that capillary water is unable to push them apart and produce instability, as it does in the untreated soil. The asphalt

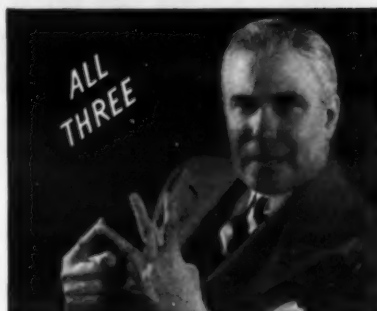
would not be likely to emulsify again.

Sub-Oiling Operations

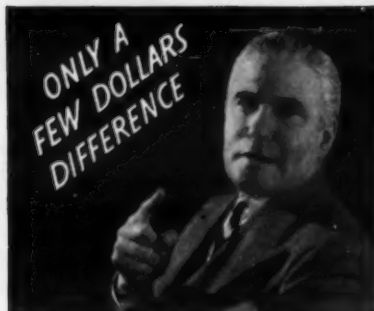
Another method for incorporating bituminous material in the soil is sub-oiling, using liquid asphalts in quantities varying from 2 to 3.8 gallons per square yard at depths of from 2½ to 5 inches. The sub-oiling machine used is a tooth scarifier with the teeth carried on an A-frame and spaced approximately 2½ inches apart. An oil line is attached to the back of each tooth running nearly to its point. In hard or quite thoroughly compacted soils the roadway to be treated is first scarified. The sub-oiler, pulled by a truck or light tractor, then follows down the roadway with the teeth set to penetrate to a predetermined depth. A bituminous distributor or supply tank follows along beside the sub-oiler and provides the necessary amount of bituminous material which is pumped through the oil lines into the

(Continued on page 25)

LET'S TALK TRUCK PRICES!



Yes, you just bet it pays to look first at the price when you start comparing America's three lowest-priced trucks. Many truck buyers are literally amazed when they see how close together the delivered prices are!

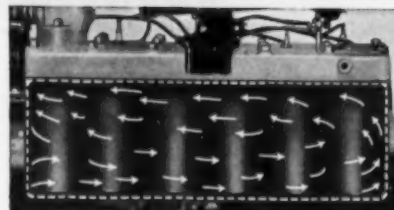


One way or the other, there is only a few dollars difference today between any corresponding models of the three lowest-priced trucks. This is especially true when wheel-base and extra features are considered.



This means one thing sure! You don't need to consider price at all today when you compare lowest-priced trucks. The thing to do is to get a "show-down" on features. Figure what you really get for your money.

NOW COMPARE VALUES



Only one low-priced truck gives you a 6-cylinder, economical L-head engine with exhaust valve seat inserts, full-length water jackets, aluminum alloy pistons, 4 piston rings, spray-cooled exhaust valve seats, oil cooling. That truck is DODGE!



Only one truck of the lowest-priced three gives you hydraulic brakes proved and perfected in many years of actual truck operation. DODGE pioneered this great money-saving feature.



Full-floating rear axle is another of the many quality features pioneered by DODGE in low-priced trucks. DODGE introduced the full-floating rear axle to save upkeep expense for you, make your truck more serviceable and dependable.

SAVE UP TO \$95 A YEAR ON GAS ALONE



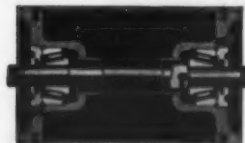
NEW DODGE COMMERCIAL EXPRESS—116'
W. B.—6-cyl.—Fast, easy to handle, dependable. Built to do a lot of work in a day! Has all the famous Dodge quality features to save gas, oil, tires, upkeep... **\$500***



NEW DODGE 1½-TON STAKE—136' W. B.—6-cyl.—Gives you 6 special oil and gas saving features, genuine hydraulic brakes, many engineering advancements... yet priced down with the lowest... **\$690***

*List prices at factory, Detroit, subject to change without notice. Special equipment, including dual wheels on 1½-ton, extra.

Through the Official Chrysler Motors Commercial Credit Company New 6% Time Payment Plan, you will find it easy and economical to arrange time payments to fit your budget.



"CONWEIGH" Trougher No. 25

Conweigh presents an advanced design which provides the ultimate in economy performance and service... Write for new Catalog describing the complete Conweigh Line... Our line of Portable and Semi-Portable Conveying equipment is described in our Catalog of "Porta Conveyors."



PORTABLE MACHINERY CO.
Division of A. B. Farquhar Co., Limited
BOX C-1, YORK, PA.

REPORTS from users of new Dodge trucks indicate savings on gas alone of up to \$95 a year. Extra savings on oil, tires and upkeep are just as sensational. Dodge gives you new "Fore-point" load distribution to increase hauling efficiency... dozens of extra-quality features like safety-steel cab and 4-bearing crankshaft that make your truck last longer, make it

a better investment. When your Dodge dealer urges you to get a "show-down" of Dodge against the others, he has in mind all the cost-cutting advantages that Dodge alone gives you. He especially invites you to make the free prove-it-yourself gasometer test. Get the facts. See your Dodge dealer today!

DODGE DIVISION OF CHRYSLER CORPORATION

Dependable

DODGE TRUCKS

STILL PRICED WITH THE LOWEST

\$370*

½-TON CHASSIS, 116' W. B.



GROUND GRIP TIRES

*Speed Up
Operations*

CUT DOWN COSTS!



HERE is super-traction—at lowest cost! On even the toughest jobs Ground Grip Tires save both time and money. These rugged tires pull equipment through sand, loose gravel, broken ground, mud, without chains. You will cut down your operating costs by eliminating delays, doing more work in less time. These remarkable tires make their own road—and they do not bump when driven on paved highways.

Firestone patented construction features give these tires tremendous strength to withstand the extra stresses and strains of super-traction. Gum-Dipped cords—soaked and coated with pure liquid rubber—make the tires stronger and more flexible. Two extra layers of these cords make the self-cleaning, super-traction tread and the body of the tire one inseparable unit.

Operate your equipment more economically—equip with Ground Grip Tires! See your nearest Firestone Auto Supply and Service Store or Firestone Tire Dealer at once.

Listen to the Voice of Firestone featuring Richard Crooks or Nelson Eddy — with Margaret Speaks, Monday evenings over Nationwide N. B. C. — WEAf Network

Firestone

A New Self-Expanding Cork Expansion Joint

The latest improvement in cork expansion joints for concrete pavements is one which comes in a moisture-proof wrapper and when installed, minus the wrapper, absorbs moisture from the air and expands to a tight fit in the pavement. This SE cork expansion joint is a new product of Johns-Manville Corp., 22 E. 40th St., New York City.

In making self-expanding joints the material is first fabricated into the standard J-M cork expansion joint material. Then the moisture is removed and the cork compressed to approximately 60 per cent of its original thickness. To hold this SE joint in its compressed state, it is necessary only to prevent re-absorption of moisture, so immediately after compression it is wrapped in a special water-resistant package which is not removed until just before installation.

In its application to old construction, this new cork joint is unwrapped at the job, immersed in water to hasten the expansion which would normally come through exposure to the moisture in the air, then slipped into place. The moisture causes the cork to expand, filling the slot snugly, and providing a tight seal against water, dirt and other foreign material. Applied to new highways it is slipped into place without immersion in water. The moisture in the wet concrete is slowly absorbed by the cork and, as the concrete hardens, the joint expands to provide a tight joint without setting up any strain in the concrete itself.

Swivel-Mounted Cylinder On Hydraulic Dirt-Mover

In order to reduce the wear on the hydraulic cylinder controlling the operation of the Blaw-Knox-Ateco hydraulic Dirtmover the cylinder and piston is swivel-mounted. Side slip of the wheel assembly on side hill operation would cause considerable wear on the packing and cup leathers so that there might be a tendency to lose pressure if the hydraulic cylinder were mounted rigidly. This is overcome by the new mounting shown on the 3-yard unit exhibited at the Road Show in Cleveland by the Blaw-Knox Co., 2067 Farmers Bank Bldg., Pittsburgh, Pa. The Dirtmover is also equipped with pneumatic tires and a bowl tilting device to permit deeper cuts on one side than on the other.

The entire operation of the Dirtmover is controlled with a single lever by the

tractor operator. The control is hydraulic, actuated by a pump mounted on the tractor and operated from the power take-off. The entire construction of this Dirtmover is strong so as to withstand all of the power of the tractor, and ball bearings in the wheels reduce wear to a minimum. The box section construction of the bowl and slip tongue lengthens the life under difficult working conditions.

Diesel Electric Generators Described in New Booklet

Three sizes of diesel electric direct-connected generator sets are described and illustrated in a new booklet recently issued by the Caterpillar Tractor Co., Peoria, Ill. Each unit consists of a Caterpillar diesel engine equipped with auxiliary fuel pump with one-gallon overflow tank, close regulation speed governor and manual control, direct-connected to an electric generator and assembled on a cast iron base.

The sets are of 60, 40 and 25 kw and each may be had in either DC or AC models.

Direct current generators are compound wound, though shunt wound machines can be furnished upon request. The alternating current generators are of the rotating field type with damper windings, making possible parallel operation. The 6-cylinder Caterpillar D13000 diesel engine powers the

60-kw set, the 4-cylinder D8800 engine powers the 40-kw sets and the 3-cylinder D6600 engines is used on the 25-kw models. General Electric, P & H, Westinghouse, or Crocker-Wheeler generators will be furnished at the customer's option.

Copies of the booklet "Caterpillar Diesel Electric Generating Sets" may be secured direct from the manufacturer by mentioning this magazine.



It Will Pay You To INVESTIGATE MALL CONCRETE VIBRATORS

GAS ENGINE

ELECTRIC

They cut labor and cement costs, produce stronger concrete without honeycombs or voids, and eliminate expensive patching. In labor saving alone, a MALL will pay for itself on a small job.

Write for bulletins . . . and let us advise you regarding the proper MALL unit for YOUR work.

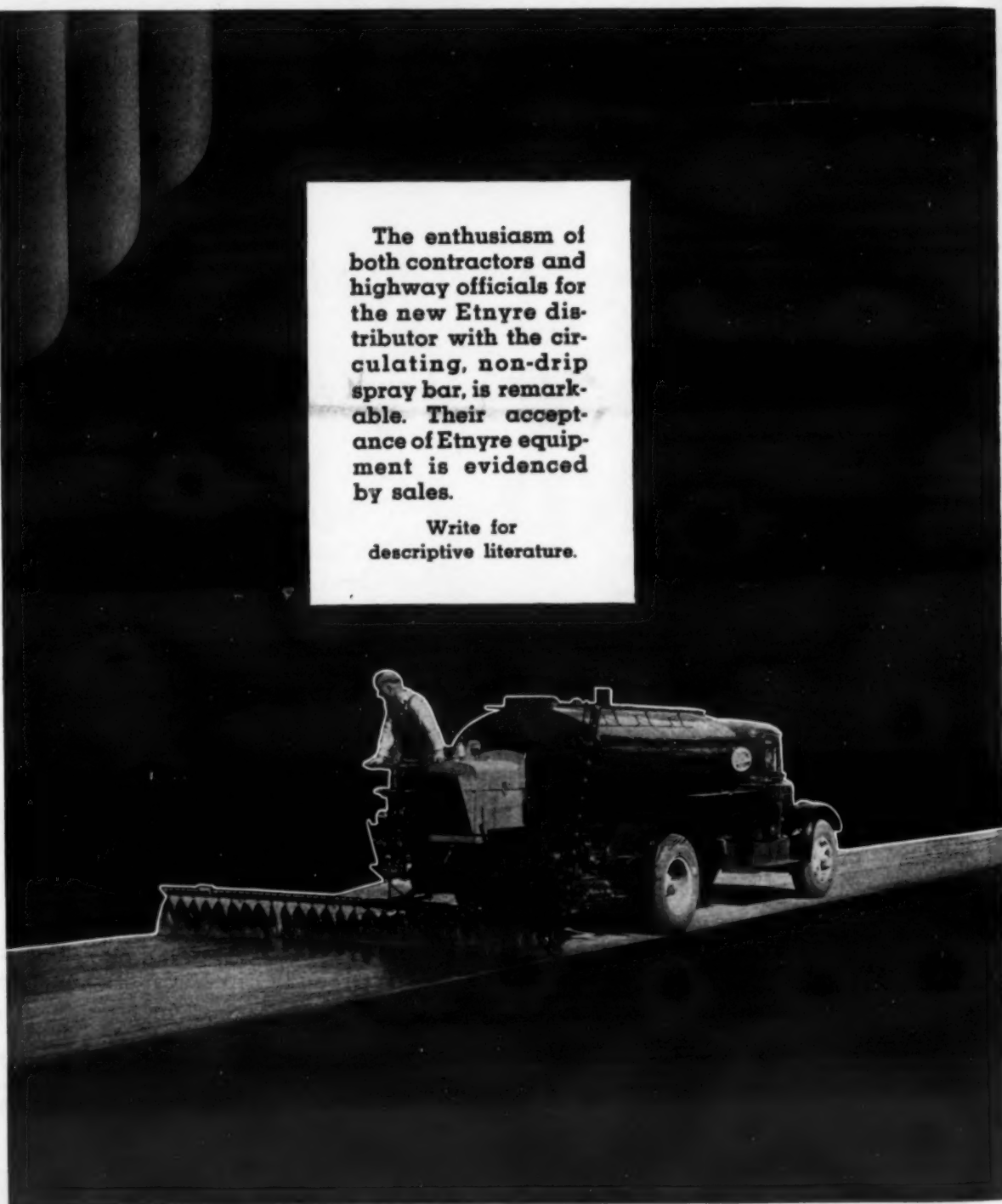
MALL TOOL COMPANY

7743 South Chicago Avenue

Chicago, Illinois

The enthusiasm of both contractors and highway officials for the new Etnyre distributor with the circulating, non-drip spray bar, is remarkable. Their acceptance of Etnyre equipment is evidenced by sales.

Write for descriptive literature.



MULTIPLE-ROPE, POWER-ARM, POWER-WHEEL DRAGLINE BUCKETS

THE DIGGING DEMONS!

A comparison of output speaks loudly in favor of Williams Buckets. Write for Bulletin.



THE WELLMAN ENGINEERING CO.
7002 Central Ave., Cleveland, Ohio

WILLIAMS
BUCKETS

E. D. ETNYRE & CO.

DEALERS IN ALL PRINCIPAL CITIES

400 JEFFERSON ST.,

OREGON, ILL.

High-Speed Excavator

A new excavator featuring speed, strength and stamina was introduced by Bucyrus-Erie Co., South Milwaukee, Wis., at the Road Show in January. This 48-B is reported to handle as rapidly and as accurately as many of the smaller machines. It is designed to coordinate the hoist, crowd and swing motions and is balanced for a fast digging cycle. It is easily converted as a shovel, dragline, clamshell or lifting crane. The dragline-crane boom is built of alloy steel angle chords, with welded tubular cross bracing and is available in lengths from 50 to 100 feet. The high A-frame with special dragline boom-suspension tackle reduces stresses on the boom and lessens the weight at the boom point.

There are three mountings—standard, oversize, and special oversize. Slide-in crawlers permit quick shipment on a single car without dismantling. There are 128 anti-friction bearings, assuring minimum wear on all moving parts and less frequent adjustments. The shipper shaft is centrally located, there are twin, 42-inch, live sheaves, arc-welded outside dipper handles, and a powerful, positive chain crowd.

On the 48-B, Bucyrus-Erie introduces Perma-Speed control, a new development of smooth and accurate control of the clutch and brake. With this control the operator has in his hands accurate control of every motion of the machine and he is assured that the adjustments he makes "stay put" until he changes them. This also reduces fatigue-slow-down.

New Road Planer for Use with 1½-Ton Truck

The Galion No. 6 road planer is the latest, lightest and smallest of the line of planers made by the Galion Iron Works & Mfg. Co., Galion, Ohio. Designed for use on roads, drives, airports, athletic fields and similar work, it is also adaptable for maintaining dirt, stone or gravel berms as well as for spreading black top or resurface material.

This road planer, though small and light, is sturdily built. The blades and runner soles are easily replaced when worn down after long service. The speed at which the machine can be worked is governed by the type of surface and condition of material.

The planer is designed with two front blades set to form a V which shave and shear off ridges and high places and mix and carry material to a center gate where a valve is located. This is a three-position valve which can be set to divide the flow of material from the first two blades or defect it to either the right or left side of the machine. The V arrangement of blades tends to hold the machine to its course even when working hard dry surfaces. The second pair of blades, also set in a V but with the point of the V forward, conveys this material back to the sides, filling depressions and delivering surplus through an open space at the ends of the blades.

THE PARSONS CO.

Manufacturers of

- TRENCH EXCAVATORS
- TRENCH BACKFILLERS
- TERRACING GRADERS
- SNOW PLOWS
- ROAD RECLAIMERS
- BLACKTOP TRACTION MIXERS

Write for printed matter

THE PARSONS CO.
NEWTON, IOWA



The New Bucyrus-Erie 48-B Excavator

The unit operates on two long straight edges 17 feet 2 inches in length which are equipped with material retaining gravel shields so that excess material can not spill over the runners at the ends of the second pair of blades.

At the rear of the machine is a full width strike-off blade which is adjust-

able to a number of positions and angles and can be set to convey material to either side of the machine. This blade makes a final distribution of the material, levels it and maintains the crown.

The total blade length is 22 feet. Material is worked back and forth along this blade length, is thoroughly broken up and mixed and is distributed over the full width of the swath. This blade length gives in one trip over the surface the equivalent blade action of three trips with a single blade grader, according to the manufacturer.

Convenient screw adjustments with hand cranks are provided for maintaining the desired adjustment of the blades. The operator's platform is roomy and is located in the center of the machine where work is in full, unobstructed view of the operator. A single cylinder hydraulic lift is provided for raising the machine so that it is supported on the wheels for towing. Wheels for transportation are mounted on taper roller bearings and enclosed in dustproof hubs

fitted with hub caps packed with grease. Rims are drop center to which 18 x 4.00 pneumatic tires are fitted.

Highways in Quebec in 1935

During 1935 the Department of Roads of the Province of Quebec maintained 15,993 miles of improved highways, of which 5,706 were main highways and 10,287 were secondary and local roads. Permanent pavements were constructed on 91 miles of highways already improved and work preparatory to laying permanent pavement was done on 76 miles.

Construction work on main highways totaled 90 miles and on municipal highways 638 miles; construction work was started but not completed on 645 miles. Angles, curves and other dangerous places were ironed out on 148 miles of road, five level crossings were eliminated and 343 bridges and culverts were rebuilt or repaired.

Quebec's highways have been a main factor in inducing large numbers of U.S. tourists to visit that province.



Socony Penetration Asphalt, Standard Brand, Connecticut State Highway from Westport to Wilton



- Socony Asphalt Road Oils
- Socony Asphalt Joint Fillers
- Socony Waterproofing Asphalt
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- Socony Refined Asphalt for sheet asphalt paving
- Socony Cold Patch Asphalt for all types of patching
- Socony Asphalt Binders B & C for penetration work (Asphalt Macadam)
- Socony Paving Asphalt 51-60 and 61-70 Penetration for the mixing method (Asphaltic Concrete)
- Socony Asphalt Emulsion for Surface Treatment, Penetration, Road and Plant Mix, and Patching

Specifications and all other particulars furnished on request.

SOCONY-VACUUM OIL CO.

INCORPORATED

STANDARD OIL OF NEW YORK DIVISION

Wet Trench and Dry— A Contractor Can Try

DRAINAGE Contractors, Inc., of Detroit, Mich., was the low bidder on Beulah Road District Sanitary Sewer Contract No. 35, in Columbus, Ohio, which required the laying of 1,460 feet of 21-inch vitrified pipe, 2,600 feet of 18-inch, 1,310 feet of 15-inch, 4,470 feet of 12-inch, 360 feet of 12-inch in tunnel, 1,780 feet of 10-inch, 120 feet of 10-inch in tunnel, and 2,420 feet of 8-inch pipe. There were also 58 manholes in the contract. The contractor made excellent progress when the conditions were even fair, laying 160 feet in five hours, but he also laid as little as 6 feet of pipe in five hours due to wet trench.

A power trenching machine was used for all the excavation, the machine being the contractor's own mating of the front of a Buckeye traction ditcher and the rear of an Austin trencher. The trench varied in depth from 12 to 16 feet and was sheeted continuously at the wet points, which were frequent. In clay and loam it was possible to place the sheeting on 3 to 4-foot centers with perfect safety. Water was quickly removed from the trench with a Barnes duplex pump but at one point every time a laborer drove his pick into the earth at the side of the trench another miniature spring started its contribution to the flow. The sheeting was held in place entirely with Simplex trench braces.

An experimental section of about 300 feet of sewer was laid with the Weston gasket and form type of cement joints to determine whether a modification of the contract should be entered into to permit its use. The joints are made up with a metal gasket placed over the spigot end of the pipe to center the spigot in the bell and also to prevent the flow of grout into the pipe. The outer collar or form is then placed over the bell and tied with the wire on the spigot end. A heavy flexible rubber tube is inserted under the collar before it is tied to insure the proper space for grout. Subsequent to the removal of this tube, grout is placed in the form with a funnel and metal tube into which the 1 to 1 grout is poured and then forced into the joint by means of a

Water in Narrow Trench Required Full Sheetting But Work Progressed Well on Columbus Sewer

plunger. This joint completes the pipe joint for all but the top third of the pipe which is finished by hand.

The backfill for the trench was made with a Buckeye power backfill machine.

Personnel

The contractor for this section of the Beulah Road sewer was Drainage Contractors, Inc., of Detroit, Mich., well-known in this type of work. John Vantrelle was Superintendent for the contractor. For the City of Columbus the work was under the general super-

vision of the Division of Engineering and Construction, of which P. W. Maetzel is Chief Engineer, with O. Bonney, Sewerage Relief Engineer in charge of the design and construction of sewers, D. T. Mitchell, Chief Field Engineer in charge of construction and L. E. Vandegrift, Engineer in charge of this section. John H. Gregory is Consulting Engineer for the City. The PWA is represented by L. A. Boulay, State Engineer, and J. B. de Hamel, State Engineer Inspector.

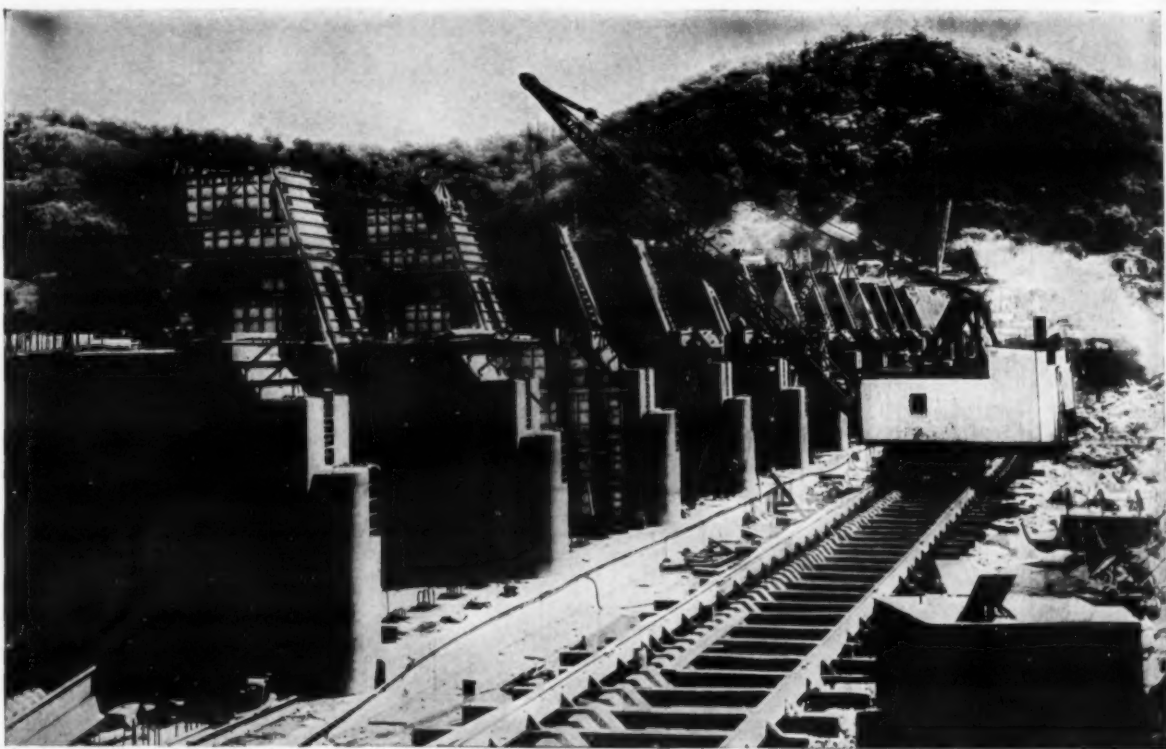
Noted Diesel Designer Visits United States

J. H. Pitchford, the diesel specialist and assistant to H. R. Ricardo of Ricardo & Co., Research and Consulting Engineers, Shoreham, England, is visiting the United States and consulting with the engineers and research staff of the Waukesha Motor Co., and other licensees under the Ricardo patent for diesel engines. Mr. Pitchford has been

associated with the Ricardo Laboratories for ten years and has devoted the entire time to research and the development of the high speed oil engine.

Mr. Pitchford reports, "There are now twenty-seven licensees of the Ricardo diesel patents distributed all over Europe building Comet diesel engines ranging in size from 26 cubic inches to nearly 1,000, operating at speeds from 800 rpm to 3,800 rpm. The engines built in America by the Waukesha Motor Co. have all of the best features used by our European licensees, and besides that there are a lot of purely American refinements that we on the other side might use to advantage."

The National Economic Council of China announced that at the end of 1935 there were approximately 56,000 miles of automobile highways completed in China. Highways in Kwangtung, in which Canton is located, consist of 6,800 miles, leading all other provinces in road construction.



American Revolver on Dam No. 4, Mississippi River at Alma, Wis.—United Construction Co.

MEET OVERLOAD CONDITIONS WITH AMERICAN "REVOLVER"

On the big construction jobs where output demands are unusually heavy and the cry is ever speed and more speed, the answer is super heavy-duty equipment like the "AMERICAN REVOLVER."

A full-revolving large capacity crane, the "REVOLVER" combines the range and stability of the derrick, the mobility of the locomotive crane, and the strength of the dragline. While simplicity is the keynote of its design, its rugged construction and air operated frictions insure speedy and easy operation and enduring service even

under the most exacting conditions—a factor making for low cost operation and maintenance.

Especially ideal for bridge and dam construction, for heavy storage and cargo crane work, the "REVOLVER" is built in sizes capable of handling loads of from 7,500 to 50,000 pounds. It can be had for track, wheel, crawler, skid, ship, barge, or tower mounting and can be furnished with steam, gasoline, electric or Diesel power.

Write us today for our latest Bulletin No. 81, which describes and illustrates the "AMERICAN REVOLVER."

AMERICAN HOIST & DERRICK COMPANY

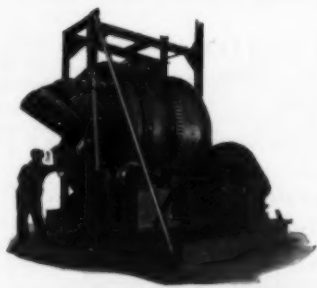
SAINT PAUL, MINNESOTA

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AMERICAN  REVOLVER

Ransome



**60 RANSOME
BIG MIXERS**

*used in 38 central
mixing plants*

- Paving Mixers
- Pneumatic Placers
- Pneumatic Grouters
- Tower & Chuting Plants

**Ransome Concrete
Machinery Company**

Dunellen, New Jersey
Cable Address "Racomaco-Dunellen"

Concrete Slab Design Used in Kent County

In discussing the general features of the design of cement concrete pavements at the Thirty-Third Annual Convention of the American Road Builders' Association, Otto S. Hess, Engineer-Manager, Kent County Road Commission, Grand Rapids, Mich., called attention to the slab design which he has used successfully for the past nine years. This slab is constructed as a single unit 50 feet long with the thickened edge all the way around the slab and fabric reinforcement to prevent cracks is used throughout.

A $\frac{3}{4}$ -inch premoulded asphalt expansion joint is used at the end of each slab and the slabs are not connected by dowels or other means for transferring loads at the joints. The loads are taken care of by the thickened edge at the joint. Mr. Hess reports that these pavements have remained smooth throughout the years and are practically free of accidental cracks. The thickness of the slab is varied to suit traffic and subgrade conditions. His experience would not indicate that connections at the expansion joints are necessary in order to prevent roughness at the joints. There has been no instance of a transverse accidental crack at the point where the slab thins down to normal thickness.

New Georgia Member of Toncan Culvert Mfrs. Assn.

The Toncan Culvert Manufacturers' Assn., Republic Bldg., Cleveland, Ohio, has announced the appointment of the Tri-State Culvert & Pipe Co., Glenwood Ave., Atlanta, Ga., as a new member of the Association. The plant will be operated by L. J. Moore, who has a wide range of experience in the culvert business. This company has the sales rights on Toncan iron corrugated pipe, Toncan iron sectional plate pipe and arches and allied products in the states of Georgia and Florida.

Moving Frozen Ground on 400,000-Yard Contract

First clearing away a covering of $2\frac{1}{2}$ feet of snow, John F. Bloomer, contractor, working in Bayfield County, Wisconsin, near Iron River, used a fleet of 95-hp Caterpillar tractors pulling 12-yard Le Tourneau Carryall scrapers to bite through a frost layer averaging 4 inches deep and moved 140,000 yards of wet and frozen sand in 1,922 tractor-hours of operation. This highway contract operated 22 hours a day and required working on a 12 per cent grade. Each tractor under these conditions made a round trip on a 1,300-foot haul in 8 minutes with an average of 8 yards per load. Most of this yardage, however,



Undaunted by One of the Coldest Winters on Record, John F. Bloomer, Contractor, Worked Throughout the Coldest Weather on His Highway Grading Contract in Bayfield County, Wisconsin

was moved on a 600-foot one-way haul. Bloomer started his 400,000-yard contract the last day of the old year and at the end of the first two weeks of 1936 he had moved 40,000 yards and

one month later, the total was up to 140,000 yards. He reports the fuel consumption as averaging 5 gallons of low-cost fuel oil per hour per diesel tractor.

Semi-Portable Plants For Gravel Aggregate

A large market for semi-portable plants for the production of aggregate has developed throughout the country, particularly among contractors who wish to set up their own plants for the production of aggregate on isolated jobs. Bulletin 269, just issued by Smith Engineering Works, 4014 North Holton St., Milwaukee, Wis., not only gives a complete description of semi-portable plants but shows various types of layouts so that the contractor may set up his own plant in an economical manner, depending upon the capacity and other requirements.

Rural electrification was advocated because it would tend to build a strong rural population. In order to bring social advantages and to build up a strong citizenry, the development of an adequate secondary road system goes hand in hand with rural electrification to achieve this objective.—J. D. Adams, Chairman, Indiana Highway Commission.



PREPAREDNESS *Wins*

Have you a good memory as far as the past winter is concerned?

If so, you will agree that it is not too early to begin to work out your plans and think about your preparations for battles with the snow during the winter of 1936-37.

Many states, counties and municipalities have faced considerable criticism during the past few months on account of their lack of efficient snow-fighting equipment.

WALTER Snow-Fighters, with their four-point positive drive and 100% traction, have gained a national reputation as the best obtainable snow fighting equipment, solving the most difficult snow removal problems.

Repeat orders from satisfied customers furnish the best proof of our success in furnishing rugged and durable equipment. In our advertisement in the May issue of this publication, we will tell you something of the use of WALTER trucks for hauling, maintenance and general utility purposes during warm weather months.

Illustrated bulletins showing our equipment in action will be sent you on request.



WALTER MOTOR TRUCK COMPANY

1001-19 Irving Avenue, Ridgewood, Queens, Long Island, N. Y.

SAUERMAN LONG RANGE MACHINES

POWER DRAG SCRAPERS
SLACKLINE CABLEWAYS
SLACKLINE SCRAPERS
TAUTLINE CABLEWAYS
SCRAPER-LOADERS

If you have a problem of digging, conveying or stockpiling earth, clay, ore or bulk materials, write for the Sauerman catalog.

SAUERMAN BROS.
464 S. Clinton St., CHICAGO

Herrick of Iowa Runs Well-Organized Job

(Continued from page 1)

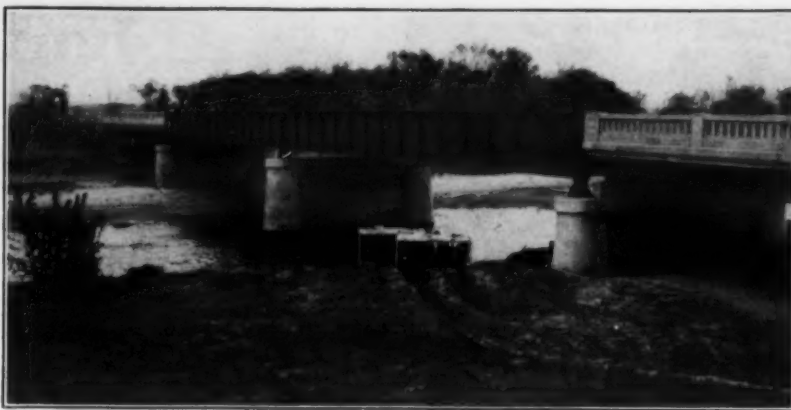
teen trucks of one-batch capacity each handled the materials on a 1½-mile dead haul average from the first set-up. The fleet was owned entirely by the contractor and consisted of Chevrolet trucks with Anthony bodies having gravity dump and a special positive safety catch developed by the contractor and on which patents have been granted. The catch consisted of a handle free to rotate and set on the front of the frame of the truck just ahead of the front of the body. A chain attached to the body was looped through the handle and the latter turned down, preventing the body from tipping up during hauling. A turn of the handle upward releases the chain and the body can be quickly dumped.

At the yard established near the batchers, the master mechanic had his headquarters with two helpers and every truck was watched with careful eyes on each trip. With anyone's chore boy as a truck driver most anything can happen to trucks that are driven over rough sections of grade. Watchful care was necessary to keep them all on the job all the time.

The crushed stone was wet down in the cars to permit the rock, which is somewhat porous, to absorb as much water as it could hold and thus protect the water of the batch and allow it to do its work in completing the reaction of the cement to form the concrete.

Handling the Bulk Cement

The cement platform located about 450 feet from the batchers extended across two freight cars and was about 11 feet wide. There were four men on the cement platform, each shoveling to their own cement buggy, wheeling to the Fairbanks scales located at the center of the platform and then wheeling in turn to the single dumping trap at the end of the platform. This was necessary because of the narrowness of the right-of-way secured by the contractor to reach his batching plant location from the highway. The dumping trap consisted of a pair of channels as tracks for the buggies which were dumped through a sheet metal chute or baffle which was lifted as the trucks backed under the trap to allow the canvas skirt to clear the truck body. The area below was well shielded with burlap curtains to prevent the blowing of the fines out of the cement during dumping. As the trucks drove away two men stepped onto the truck and covered the cement with the sand to prevent the strong winds from blowing the cement off the batch during transit.



C. & E. M. Photo

One of the Major Bridges on the Project and the Dual Pumps for Water Supply

Reshaping the Grade

As is always the case when a grading contractor has left the grade for a paving contractor to use for pouring a slab, there were high spots, low spots and the changes of grade determined by the engineers to give better grades at crossings

and for approaches to structures. This contract was no exception and the contractor had to place a Stroud elevating grader, with the belt driven from the wheel, on the job to take care of coring out sections where the grade was high. At one point there was particular trouble

with the grade as the fill had been built with the soil from an adjacent bottom where gumbo clay predominated. This would not work satisfactorily because of wet weather and had to be cored out and replaced with suitable material as the paver was rapidly approaching the section.

A Lakewood Graderooter tore out sections that had to be removed and a Caterpillar Sixty with a Caterpillar 12-foot blade shaped up the rough grade. A Caterpillar Thirty with a Euclid rotary scraper was used for building up low grade. A Ted Carr Formgrader cut the form trench and then five men handled the setting of the Blaw-Knox 10-inch steel forms. A Caterpillar Fifteen motor patrol grader worked just ahead of the forms cutting the thickened edge trench 4 feet wide along the forms.


The final cutting of the grade was with a Lakewood subgrader pulled over the forms and the excess dirt shoveled out by the fine grade crew of about eight men who also tamped forms and aligned

(Continued on page 26)

CHEVROLET TRUCKS

lead all trucks in their price class for PULLING POWER

FOR ECONOMICAL TRANSPORTATION

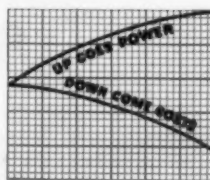



Chevrolet trucks prove stamina and record-breaking economy in amazing coast-to-coast run

Look at this great record

Location of Test.....	Los Angeles to New York
Distance Traveled.....	5511.5 miles
Running Time.....	129 hours, 24 minutes
Average Speed.....	27.14 miles per hour
Gasoline Used.....	308.6 gallons
Gasoline, miles per gallon.....	11.378
Oil Consumption.....	3 quarts
Cost of Fuel.....	\$57.59
Cost of Oil.....	\$6.67
Fuel and Oil (cost per mile).....	\$0.016
Average cost per ton mile.....	\$0.0328
Water Consumption.....	1 gallon
No mechanical failures	

Entire test conducted under supervision of A.A.A. Contest Board—Sanction No. 3396.



No other truck in the entire low-price range equals the Chevrolet 1½-ton truck for pulling power! And yet this is just one of many advantages contributed by the Chevrolet High-Compression Valve-in-Head Truck Engine. It offers unmatched

economy of operation—high gasoline mileage and low oil consumption. For dependability it is unsurpassed by any truck in its price range. That means low maintenance cost, too!

Perfected Hydraulic Brakes—the kind that are always equalized—give great and reliable stopping power. The **Rear Axle** is of **Full-Floating** design—rugged and durable in construction. And the **Cab** is **Full Trimmed**—designed for real driver comfort.

Chevrolet trucks are the world's *thriftiest high-powered trucks*. Give them a trial—with your kind of loads. Your Chevrolet dealer will arrange such a test at your convenience.

CHEVROLET MOTOR COMPANY, DETROIT, MICHIGAN

GENERAL MOTORS INSTALLMENT PLAN—MONTHLY PAYMENTS TO SUIT YOUR PURSE

PILE HAMMERS
and
EXTRACTORS
HOISTS — DERRICKS
WHIRLERS

•
Special Equipment
Movable Bridge
Machinery

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Write for descriptive catalogs.
McKIERNAN-TERRY CORP.
19 Park Row, New York
Distributors in Principal Cities

Overpass on Curve Replaces Narrow Bridge

FACETIOUSLY referred to as the "Bridegroom's Bridge" because the Superintendent went away on a short honeymoon during its construction, a new steel I-beam structure of two 40-foot spans and one 63-foot, 2-inch span was built last spring on Indiana State Routes 43 and 25 just south of Lafayette, Ind., home of Purdue University. This structure, Project 43-K-924, was built on a superelevated curve of 3 degrees, 40 minutes, the superelevation being 1.2 feet. The overall width of the bridge is 32 feet 6 inches and the clearance above the top of the rails 22 feet 3 inches.

Excavation of the west piers was started February 28, 1935, with a Northwest crane and clamshell bucket. The west piers were carried 7 feet below the top of the track where hard blue clay was encountered. The west abutment foundation was carried to a depth of 27 feet and the east abutment 32½ feet deep.

Footings and Columns

The west pier footing is 6 x 32 feet and 4 feet high with an unusually large amount of reinforcement. No water was found in the excavation for any of the footings nor was there any rain to cause any trouble from surface water. The east pier footing is the same size as the west abutments. Both have three counterforts 4 feet wide and extending out 7 feet from the 6-foot section. Each pier carries three columns measuring 3 x 2 feet at the top and battered 1 inch per foot on the outside, with the center column uniform throughout its height.

Column Forms and Concreting

The column forms were built up of 5/8-inch plywood with 2 x 6-inch studs every 9 inches and double 2 x 6's for wales spaced 9 inches apart at the bottom and gradually widened to 14½ inches at the top. The close spacing of studs and wales was necessary because of the change to plywood instead of using the standard form lumber. These forms stood the rapid pour of the columns at the rate of a yard of concrete every two minutes without any deflection of the plywood. The concrete used had a slump of 1¾ inches.

All concrete was mixed in a Foote 27E paver and the batches hauled dry from a Johnson weighing batcher in an International 1-batch truck. The concrete was swung in a 1-yard bottom-dump bucket by the Northwest crane with a 60-foot boom and placed in the columns with "elephant trunk" chutes. The concrete was vibrated internally with a Mall gasoline vibrator causing the dry mix to settle quickly around the heavy reinforcing.

Anchor bolts for the I-beams were cast in the caps of the abutments and the caps of the piers, and in spite of the fact that they had to be set on a skew they were accurate and caused no trouble when the I-beams were set.

Setting the I-Beams

There were seven I-beams in each

Moellering Constr. Co. Used Plywood Forms for Concrete Bridge Columns on Job at Lafayette, Ind.

span, the center span having 36-inch beams weighing 6½ tons each and the end spans 27-inch beams weighing 2.5 tons each. All beams were set with the Northwest crane. The beams were delivered by rail and picked up and placed in one operation. The end spans were set first and then one end span, the west end, planked with 6 x 10-inch timber and the crane run out as near the end as possible. A double sling of ¾-inch steel cable was used around the beams and the boom held at 45 de-

grees. No difficulty was experienced in placing the I-beams with the crane and sling.

Forms for the Deck

The bridge deck, 7¾ inches thick reinforced with bent ½-inch rods, was poured one span at a time monolithic with the sidewalk and curb with no expansion joints between. In order to secure an accurate curve for the outside forms the Project Engineer used the off-set method of measuring the curve for the sidewalk rather than turning it off on the transit. This resulted in a smooth accurate curve for the completed structure.

The floor forms were built continuous for a single span using 1 x 8-inch lumber with 2 x 6's on 18-inch centers to support the forms. Sure-Grip wire stirrups with beam saddles were used to hold the 2 x 6's securely in place. As the contractor had not used the wire stirrups before, there was a scattering of Universal form clamps along the edge of the structure to insure a firmly

consolidated form. The bridge floor had no crown but the forms were set with a 5/8-inch camber which worked out correct to a hundredth of an inch on the finished concrete.

The end spans carried 12,046 pounds of reinforcing steel each and the center span 17,000 pounds.

Quantities

Class D concrete, 1 : 2 : 3½.....	291.5	cubic yards
Class E concrete, 1 : 2½ : 4.....	63.0	cubic yards
Hand-rail	305.67	linear feet
Dry excavation	645.00	cubic yards
Class A excavation, roadway.....	2,657	cubic yards
Borrow	42	cubic yards
Structural steel	171,000	pounds
Reinforcing steel	48,079	pounds
Reinforced concrete pavement.....	3,166	square yards

Note: Class E concrete was for the footings, and Class D concrete for the piers and deck.

Materials

The aggregates for this concrete were furnished by the Western Indiana Sand & Gravel Co., of Lafayette, Ind., the reinforcing steel by the Joslyn Mfg. Co., of Fort Wayne, Ind., and the I-beams by McClintock-Marshall Steel Co. Medusa cement was used through-

(Continued on page 24)

On the Delaware-Chesapeake Canal job, this "Caterpillar" Diesel Tractor loads, hauls 800 feet, spreads and returns—in 8 minutes flat! The loaded trip is made over adverse grade.

first IN PERFORMANCE

The "Caterpillar" Diesel Tractor is shattering cost records, boosting work-production figures. That's why it stands first today. It has set new standards for tractor power. It has brought a new basis for figuring bids and planning schedules. And it is first choice on the big jobs and the small—because it is first in performance, first in low operating costs, first in dependability and long life and low up-keep. Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

HARD FACTS ON THE SHOW-DOWN

A contractor on the Atlantic Gulf Canal reports: "Our two 'Caterpillar' Diesel Tractors haul an average of 85 cu. yds. of earth per hour on a 500-foot haul—entirely through deep sand. The cost is approximately 7 cents per cu. yd.!"

From an Iowa contractor: "With our 'Caterpillar' Diesel we haul 50% more material than with our gas tractors, and our hauling cost is cut in half."

CATERPILLAR

DIESEL

REG. U. S. PAT. OFF.

**Dependable
2" to 8"
Self-Priming
PUMPS**

*The choice of
Contractors
from
coast to coast*

Write for copy of our combined catalog
and valuable bulletin of engineering data
—sent FREE on request.

Sterling Machinery Corp.
411-15 Southwest Blvd., Kansas City, Mo.

Mo. Connects U.S. Routes with 10-Mile Feeder Road

(Continued from page 2)

30-foot boom operated by a Hercules engine and double-drum hoist handled all the steel erection. It was mounted on a 3-log skid for easy moving with a tractor.

Concrete

There were 12 box culverts on the contract ranging from 3 x 3 feet to 10 x 8 feet and in length from 27 to 44 feet. The concrete was batched in bottomless boxes in wheelbarrows by volume and mixed in a Lakewood 7S mixer. A single wood chute from the mixer drum to the top of the culvert form served to deliver the concrete which was shoveled to place by two men. There were usually four men rodding the concrete in the wall forms. Two men wheeled stone and one man handled the sand for the batches.

Fills and Embankments

The approach fills for the bridge were built up by a LaPlant-Choate rotary scraper pulled by a Caterpillar Sixty. All fills were spread in 1-foot lifts. For the heavy cuts the contractor used a 6-yard Commercial hydraulic scraper pulled by a Caterpillar Sixty. This machine not only made the cuts itself but also spread the material as desired without stopping.

Quantities

This 9.952-mile road project measured 24 feet shoulder to shoulder, with 6-foot ditches with a 3:1 slope and the backslopes 1½:1 except in cuts over 4 feet when the slope was made ¼:1. The quantities in the two sections and for the bridge were as follows:

Length	4.96 miles	4.992 miles
Clearing and grubbing.....	1.9 acres	0.8 acres
Class A excavation, earth.....	11,016 cu. yds.	5,546 cu. yds.
Class C excavation, rock.....	534 cu. yds.	286 cu. yds.
Culvert excavation.....	544 cu. yds.	762 cu. yds.
Class A borrow.....	3,754 cu. yds.	356 cu. yds.
Machine grading.....	161.35 stations	209.47 stations
Class B concrete, culverts.....	134.4 cu. yds.	113.1 cu. yds.
15-inch culvert pipe.....	256 feet	300 feet
18-inch culvert pipe.....	254 feet	256 feet
24-inch culvert pipe.....	238 feet	176 feet
30-inch culvert pipe.....	24 feet	194 feet
36-inch culvert pipe.....	76 feet	76 feet
Reinforcing for concrete.....	12,763 pounds	11,735 pounds

Bridge Quantities

Class 1 bridge excavation.....	10 cu. yds.
Class B concrete, masonry, caps.....	35.8 cu. yds.
Class X concrete, masonry, floor.....	72.7 cu. yds.
Fabricated steel, truss.....	49,800 pounds
Fabricated steel, I-beams.....	34,000 pounds
Steel castings.....	800 pounds
Reinforcing for concrete structures.....	22,890 pounds
Crossed piles in place.....	1,248 feet
Crossed piles, cut-off.....	32 feet
Crossed timber.....	1,980 feet BM

Personnel

The contractor for this work was Jos. L. Pohl of Nevada, Mo., for whom O. W. Fizzell was Superintendent. For the Missouri State Highway Department H. S. Jordan was Project Engineer.

Diesels Made Standard on All P & H Excavators

The Harnischfeger Corp., 4419 W. National Ave., Milwaukee, Wis., has announced that diesel power has been adopted as standard equipment on its entire line of excavators ranging from ½ to 4 cubic yards capacity. Although gasoline power is still available, Harnischfeger is the first of the shovel manufacturers to swing to diesels as standard equipment for its entire line. The only exceptions are found in the P & H Ward-Leonard electric machines of from 2 to 4 yards capacity and the smaller Bantam-Weights ¾ and 1½ yard, powered by Ford V-8 motors. Diesel power may also be had on the Bantam-Weights if desired.

Blaw-Knox Above Flood

Deliveries and service from the main plant of the Blaw-Knox Company at Blaw-Knox, Pittsburgh, Pa., were not affected by the recent flood conditions in the Pittsburgh district. The plant is located well above high water mark.

Work on Bridge Approach Started in St. Louis, Mo.

The driving of 600 25-foot concrete piles on the \$1,100,000 South Valley approach to the new Municipal Bridge in St. Louis, Mo., was started this month by the Smith & Brennan Pile Co., of that city. C. E. Smith & Co., engineers, of St. Louis, Mo., prepared the plans for this approach which when completed will be used by the Missouri Pacific, Illinois Central, Terminal, Chicago & Alton, Cotton Belt and other railroad lines entering St. Louis from the east side.

The South Valley approach will be 2,300 feet in length, with a maximum height of 23 to 24 feet. The substructure will be an earth embankment, supporting a steel superstructure.

The Smith-Brennan company was awarded the subcontract for the pile driving by Fruin-Colnon Contracting Co., which has the contract for the substructure for the new approach.

Cost Finding Record Book for Conveyor Belts

This is the title of a new book recently issued by The B. F. Goodrich Co., Akron, Ohio, and is available to anyone interested in maintaining a running record of conveyor performance as a means of determining actual belt cost. The book contains eleven belt and con-

veyor record sheets, the form being based upon the experience of the manufacturer in this field and the suggestions of leading conveyor engineers and users. In addition to the record forms, the book contains conveyor belt data and suggestions for prolonging belt life.

Copies of this book may be secured by readers by addressing requests to the Mechanical Rubber Goods Division of the B. F. Goodrich Co.

??-IF-??

If you need a finishing machine—any size, any type, with any special feature—if you have a tough job, then use a FLEX-PLANE Finisher.

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FLEXIBLE ROAD JOINT MACHINE CO.
WARREN, OHIO

Distinctive appearance,
after all, is an asset
to any truck owner



In this day of fast-moving and fast-changing events, business men find that many, many customers and prospective customers, in extending patronage, are influenced by the character of the trucks which stop at their doors or which they see on the streets or highways.

The improved 1936 line of quality GMC trucks—from the ½ ton delivery truck right through the entire range of medium and heavier duty equipment—is streamlined for style. Streamlined in a way that is certain

to assure distinction for any owner whose name appears on one of these modern trucks.

Add to the advertising value of GMC advanced streamlined styling such advantages as exceptional performance, long life, economy and low prices that challenge the field, and you have a combination of desirable features that no seasoned truck buyer can afford to overlook—or will overlook.

GMC prices start at \$425 chassis f. o. b. Pontiac. In every capacity range there is now an unmatched value.

Time payments available through our own P. M. A. C. plan

GENERAL MOTORS TRUCKS AND TRAILERS

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Silicosis—Its Cause and Prevention

Welton A. Snow, Safety Director, of Associated General Contractors, Discusses This Most Hazardous of Occupational Diseases

THE daily press has been giving an increasing amount of space to occupational diseases and their prevention in the last two or three months and particularly to silicosis which offers the greatest hazard in certain construction operations. Silicosis may be defined as that disease of the lungs caused by the victims breathing in silica dust. In its final stage the disease is incurable and therefore emphasis must be placed on prevention.

The danger from exposure to silica dust varies from a few months to several years. Some of the construction operations which offer silicosis hazards to workmen are: hard rock tunneling and drilling; rock quarries and crusher plants; sand pits; blasting operations, both surface and underground; grinding room operations.

Unless proper preventive measures are taken, free silica dust is produced by all of these operations and thus the workers are exposed to the hazard of silicosis.

In hard rock tunneling and drilling, one of the best preventives is to keep all surfaces wet, not only at the immediate site of the operation but also for some distance back from the face. Wet drilling should be used. Before a blast is fired, tunnel walls at and near the blast should be wet down. The tunnel floor for some distance should be wet. This will prevent the jar of the explosion stirring up myriads of dust clouds. Adequate ventilation is also necessary in order to keep the men provided with a constant supply of fresh air, free from silica dust. In dry drilling, there may be used a rather complicated and somewhat expensive exhaust system with the intakes at the shank of the drill at the surface of the rock. This requires a suction piece for each drill, connected by hose to a central exhaust plant.

Legal Aspects

Andrew J. Farrell, a Chicago attorney, long experienced in legal work with insurance companies and in the trying of workmen's compensation cases in Chicago, states: "Silicosis suits are divided into two classes according to the different state laws. The first class is under the workmen's compensation acts of several states . . . The second will be referred to as common law cases, the right to sue being created either by common law or a statute. In these cases where silicosis and kindred sicknesses are controlled by the workmen's compensation act there is not so much activity in stirring up claims, as the amount to be recovered is limited by the statutes. Under practically all workmen's compensation acts the payments are made in weekly installments and the rights of the claimant are still subservient to the powers of the industrial commission, even after trial . . . In the common law courts, however, there is no limitation as to the amount to be recovered except in a few states where there is a statutory limit on recoveries for death. The judgment in a lump sum is final after the defendant has appealed to the court of last resort and is usually paid in a lump sum."

It would appear then that employers operating in states where silicosis is compensable under the state laws are in a preferred position compared with those who are operating in states without such laws and who are constantly liable to large damage suits under common law.

Especially is this true when we consider how hard it is to defend such suits with respect to the insidiousness of the disease, and the uncertainty as to the length of period of development, especially in the first stage.

Summary of Preventive Measures

Contractors, especially those engaged in tunnel and quarry work, must appreciate the importance of the elimination of this hazard in their operations. The recommended preventive measures are:

1. Exert every effort to reduce dust hazards.
2. Keep theatre of operations wet so as to permit a minimum of dust in the air breathed by the men.
3. Use wet drilling where practical and possible.
4. Use respirators.
5. When dusty operations are confined and are of appreciable magnitude and duration to warrant the expense, install ventilating systems.
6. Require medical examination of all prospective employees before putting

them to work at occupations exposed to dust hazards.

7. Check the health of men at frequent intervals. Those showing signs of silicosis should be removed from dust exposures at once and placed where clean air is afforded.

8. Don't expose men to dust hazards if their lungs are weak or if they are in the least tubercular.

9. Recognize the fact that occupational diseases are not mythical—they are a serious reality and must be treated as such.

Flood Damage in New England

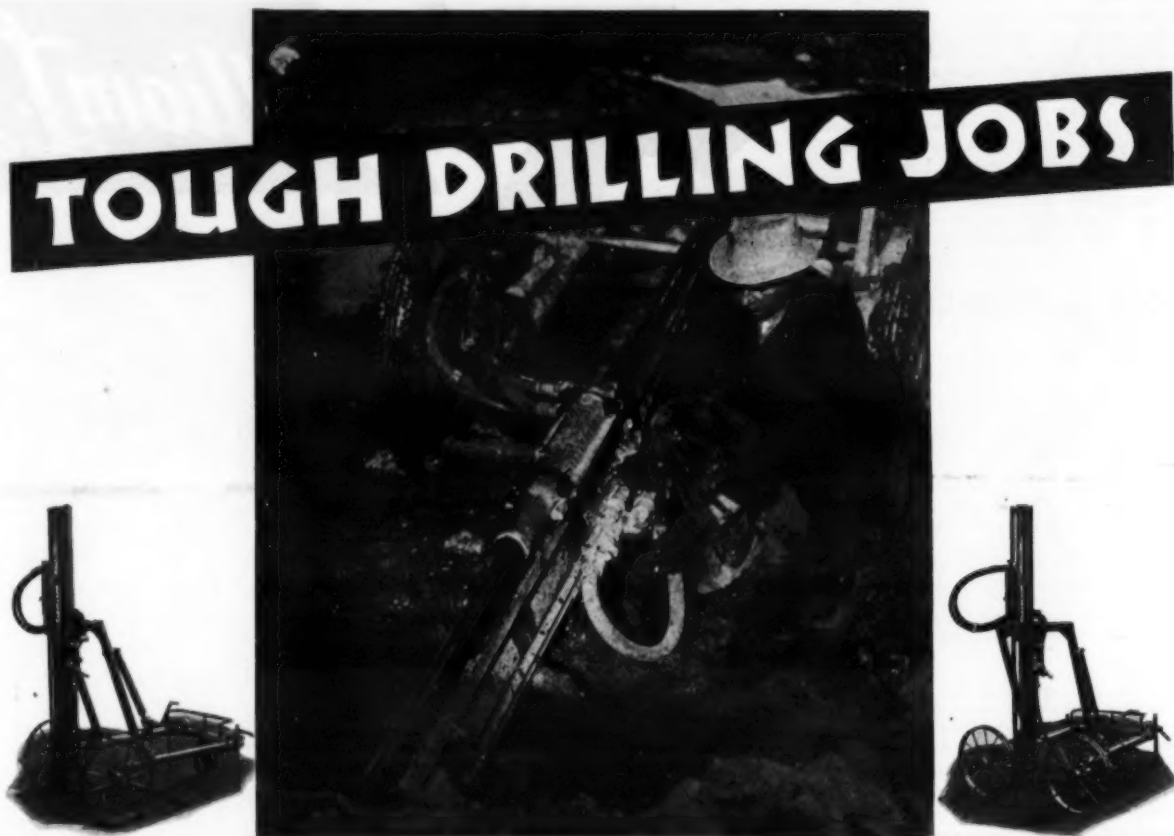
While it is not yet possible accurately to appraise the damage done to the New England states by the recent flood, preliminary estimates place the total flood loss of all kinds at \$250,000,000, according to a report in *The Nerba*.

Severe damage was done to highways and many bridges were washed out or

weakened. Such damage has been estimated at \$10,000,000 in Maine; \$1,500,000 to the state roads and bridges in New Hampshire with the injury to town and city roads and bridges running into more millions; \$8,000,000 in Massachusetts; \$150,000 in Rhode Island; and a total of \$25,000,000 for Connecticut, with no separate figure given for roads and bridges. Vermont, from available reports, was not greatly affected by the flood.

While all these estimates are preliminary and subject to correction upon the making of careful surveys, there will be a large amount of work needed to repair the wreckage.

It is uncertain how much the facilities of contractors will be used in doing the repair and reconstruction work. It is but natural that the state and local public officials will secure as much money as possible from WPA. It seems probable that the contract system will be employed, however, on the larger bridges and on the more important highway repairs.



★ THE special forte of The Cleveland DR6 Universal Drill Rig is the extra tough job, where there is a considerable depth of overburden—variable rock, soft or medium, with hard strata—or "ravelly" ground where strong rotation and blowing power are needed to get the bits out of the hole.

The Cleveland DR6 will drill holes in any direction, and at any position. While a large percentage of all wagon drilled holes are put in straight down, the DR6 is readily adaptable to drilling low, flat holes, as in the picture,

which shows the rig being operated on the San Francisco Air Port Extension Project. Note the use of pneumatic tires. They facilitate moving the rig over uneven ground, and are a surprising help in keeping the bit free when drilling.

You will want to see what a Cleveland DR6 will do on your own drilling job. Our salesmen and distributors will cooperate in every possible way. Let us send Bulletin 111 which is fully illustrated with photos and drawings.

Above, at the left, the Cleveland DR6 in position for down hole drilling. Note the convenient location of the throttle and feed control handles. The hollow frame is used as an air receiver. This arrangement separates trash and moisture from the air, and acts as a pulsation compensator, providing more uniform piston reciprocation, and consequently faster drilling.

In the illustration at the right, above, it will be noted that the wheels are swivelled 90° for line drilling. The adjustable peg seen between the wheels contacts the rock surface, and steadies the drill when in action.

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LEADERS IN DRILLING EQUIPMENT

Avoid Legal Pitfalls

These brief abstracts of court decisions may aid you. Local ordinances or state laws may alter conditions in your community. If in doubt consult your own attorney.

Edited by A. L. H. STREET, Attorney-at-Law.

Anti-Kickback Law Was Not Violated

"A \$5,000 fine, or five years in jail, or both, may be cracked down on a federal works contractor who bulldozes his employees to give up part of the pay to which they are entitled," said Uncle Sam, in legal effect, although in other words.

"You violated that law," Uncle Sam's lawyers accused some chaps in Pennsylvania.

"You're wrong," answered the contractors' attorneys. "We paid our men all that we agreed to pay them."

"Yes, but the men were skilled laborers and you paid them only as ordinary laborers," replied the attorneys.

"Suppose we did," rejoined the contractors' legal lights. "Your Uncle Samuel did not forbid that."

"The contractors' attorneys score; indictment dismissed," declared the United States District Court for the Eastern District of Pennsylvania in the case of United States v. Golder, 11 Fed. Supp. 870. Said the court, in part:

"If the workman receives the whole amount of wages which the employer agreed to pay him when he went to work and is not compelled to give back or to waive any part of it, the act has not been violated. It does not reach * * * cases where, at the time he was employed, the employee was induced by whatever means to accept a lower rate of pay than he might have insisted upon by reason of his skill, the kind of work, or his classification, or than that which the contractor had agreed with any board or public official to pay or which the government required him to pay."

Reclaiming Goods Bought on Fraud

There is an important exception to the general rule that when a seller delivers goods to the buyer on open account, they become the property of the buyer whether he pays for them or not. This exception was applied by the Florida Supreme Court in a recent case (136 So. 704.)

Supplies were obtained by a buyer on credit, under a false statement of his assets. Within less than three weeks he disappeared and a contractor, as creditor, attached his property, including the supplies.

Under these circumstances, it was decided by the Florida Supreme Court that the seller of the supplies had a right to reclaim them, both as against the buyer and the buyer's other creditors. (136 So. 704.)

The court applied the well settled rule of law that if one buys goods on credit, intending not to pay for them, or if he secures the credit on false representations as to his pecuniary resources, the seller will be entitled to reclaim the goods by acting promptly on discovering the fraud.

Contractor Did Not Question Material Cost

"If the State awards you that public building contract, we will furnish you all the such and such material that you will need for so much, subject to prompt acceptance after the general contract has been awarded," said a material man to a contractor who later bid successfully in the contract.

There was legal poison in the words we have above italicized, and every contractor should mark them well.

The day the contractor placed his bid, on the strength of the material man's offer, the latter discovered that its representative had underestimated by half the quantity of material required. The material man immediately notified the contractor of the mistake and withdrew the offer. But it was too late for the contractor to withdraw his bid without getting in Dutch.

Later he sued the material man for damages

for failing to deliver the material at the offered price, on the basis of which the contractor placed his bid for the general contract.

The United States Circuit Court of Appeals, Second Circuit, decided (James Baird Co. v. Gimbel Bros., 64 Fed. 2d, 344) that there was no binding contract to sell the materials at the quoted price. The contractor had not bound himself to buy and the material man was not bound to sell, because there had been no acceptance of the offer. And an offer is withdrawable any time before it is accepted.

But, of course, as the court observes, the contractor could have protected himself by taking from the material man an absolute contract to sell the needed material at the quoted price in the event that the contractor should get the general contract.

Check Held-Bank Failed

Said a road contractor to the Alabama Supreme Court, "We have a just offset against the amount claimed by this subcontractor. It happened this way: In April, we sent him a check, which he returned, claiming that it did not cover all that was due him. In July, we sent him another check for the same amount. Sub. did not cash it nor did he return it. More than a year later, and while he still held the check, the bank failed. We understand the law to be that if one to whom a check is issued fails to present it to the bank for payment within a reasonable time, he

becomes the 'ghost' if the bank later fails."

Replied the Supreme Court (Newell Contracting Co. v. Lacy, 155 So. 379): "The rule of law you cite is well and generally recognized, but it does not fit this case, if the check was for less than the amount due Sub. and yet you insisted that its acceptance would be in full settlement of his claim."

"There is no legal obligation to cash a check offered as full settlement of a disputed claim, because cashing it would expose the payee to a claim of having taken it as final settlement."

"True, Sub. was bound either to cash the first check within a reasonable time or return it. This he did. You, general contractor, had no right to keep sending other checks to him for the same amount, and when he refused to cash the second check and advised you that he would not cash it, you cannot reasonably say that his holding the check was the cause of your losing the deposit against which the check was drawn, when the bank failed."

Two New Cummins Dealers

The Cummins Engine Co., Columbus, Ind., has announced the addition of two new dealers to its distributor organization. They are West India Machinery & Supply Co., 23 Commercial St., San Juan, Puerto Rico, and K. A. McIntyre, 14 West Hudson St., Columbus, Ohio.



At Black Earth, Wisconsin, "Bill" Lathers used five 7 yd. Continental Scraper Wagons on a highway grading job that involved digging and handling some 149,000 yards of sandy clay mixed with shale and gravel. And what a record he made! Using "A-C, L.O's" for power on an average haul of 475 feet (1,000 ft. round trip), the Continental Wagon Scrapers handled plus 6.1 yards per load — 163 trips per 10 hour shift — 4 minutes per trip, or almost 100 yards per hour per scraper — 5,000 yards per shift with five 7 yd. Continental Wagon Scrapers — 149,000 yards in 29 days! You've read the speed record — now look at the costs! Total operating costs were *only 3.5c per yard* — including complete tractor and wagon scraper costs, operators' wages, gasoline, oil, depreciation and interest. (No general overhead or grade finishing costs included.)

"Bill" Lathers knows that Continental Wagon Scrapers are the fastest, lowest cost dirt moving equipment made. That they are lighter in weight, yet stronger and of greater capacity per pound of weight than any scrapers made. You should know, too, that they dig — load — haul — and dump over banks, or in windrows — that they backfill — turn short — dump in close quarters against walls, around culverts, and can also be used as carry wagons.

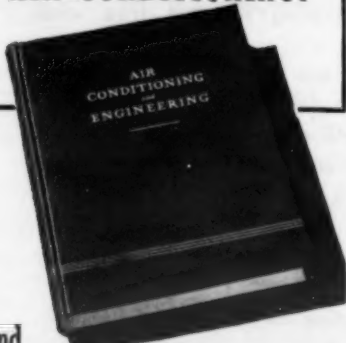
Continental Wagon Scrapers are real one-man outfits — tractor operator controls all operations — with a single valve from the tractor seat. Made in 5 and 7 yard sizes for use with crawler tractors.

For lowest cost dirt moving — use Continental Wagon Scrapers — send for user reports — do it now!

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A complete reference book on air conditioning — 692 pages of valuable data covering such important subjects as Air Flow, Sound, Control, Cooling, Heating, Ventilating, Dehumidifying, etc. Full of charts, tables, notes, references and technical information not available in any other single volume. Price \$5.00, postage prepaid.

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One of the New CMC Mixers

7S and 10S Concrete Mixers for High-Speed Trailing

Two-wheel 7S and 10S non-tilting concrete mixers which can be towed behind a truck at passenger car speed have been announced by the Construction Machinery Co., 500 Glenwood St., Waterloo, Iowa. These mixers are mounted on balloon-tired wheels, with springs to absorb road shocks, and the wheels turn on twin Timken bearings. Optional with the pneumatic-tired wheels are dual-solids or wide tread steel-tired wheels, both roller bearing equipped.

The new machines are of the end-discharge type, with Accurimeter vertical calibrated water tank with handy side dial control and Vibraflo quick-emptying streamline skip as standard equipment. The use of special abrasion-resisting steel and other alloys has effected considerable weight reduction without loss of durability.

These and other mixer innovations are described in literature which is available to readers of this magazine upon request.

New Compressor Valves Offer Larger Air Openings

A new development in air compressor valve design, known as the channel valve, has recently been announced by Ingersoll-Rand, 11 Broadway, New York City. In designing this valve a larger portion of the valve opening is utilized than is ordinarily the case, tending toward slower air speeds through the valve ports. The manufacturer states that the only moving parts of the new valve are a number of "valve channels" within each of which is a flat spring. The spring fits snugly within the channel so that when the valve lifts, the spring straightens and a small quantity of air is trapped between the spring and the channel. This forms an air cushion, the function of which is to decelerate the valve channel after opening and bring it to a stop softly and quietly without impact.

A new bulletin, printed by Ingersoll-Rand in its own shop, describes the channel valve and by an ingenious scheme makes it possible for you to take it apart yourself right in the catalog.

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Fully-Hydraulic Scraper Offered in Four Models

The Gar Wood hydraulic scraper, of special design with hydraulic equipment applying power where and in any direction required, made by Gar Wood Industries, Inc., Road Machinery Division, 7924 Riopelle St., Detroit, Mich., is offered in four models to suit particular needs.

Features of this scraper are three-point suspension eliminating twisting stresses, all wheels are within the cutting width of the bowl, the front truck arrangement gives a dual tool for a dual function, that is, during loading, the line of draft is straight from the drawbar of the tractor to the bowl and when hauling, the wheelbase is shortened to a minimum to improve maneuverability.

With a Gar Wood scraper and suitable tractor, one operator can dig, haul and spread from 500 to 1,000 yards of dirt in an 8-hour day, depending upon the size of scraper and tractor used, according to the manufacturer.

In most cases these machines are worked continuously from 12 to 20 hours in sand, clay, loam or rock.

These scrapers, which are made in 6, 8, 10 and 12-yard sizes, are described and illustrated, with complete specifications for all four models, in literature which may be secured direct from the manufacturer by mentioning this magazine.

A Maintenance Roller

A maintenance roller of unusual characteristics, making it a useful tool for rolling patches and shoulders, is made by The Wheeled Roller Corp., San Antonio, Texas. This roller consists of a drum which can be loaded with water or sand to increase its weight and steel wheels with pneumatic tires mounted off center so that when the roller is not in use, the towing tongue may be lifted up and over and the roller is then carried on the pneumatic tires for speedy movement from one operation to another. To place it in serv-



The Wheeled Roller

ice again, the tongue is turned back and the wheels are lifted leaving the roller in contact with the ground.

The roller drum is of high quality semi-steel and for the Model B, which gives compaction comparable to a 5-ton tandem roller, is 36 inches wide and 38 inches in diameter with a 2-inch thickness of shell. The tires for this unit are either 32x6 pneumatic truck type or 32x5 cushion. A water tank with caps top and bottom is installed for use when rolling asphalt or oil roads.

Complete information on this roller may be secured from the manufacturer.

Find out what's happened in the Crawler Tractor Field

Put This Tractor to the Test!



At Right: The compact, powerful T-20 TracTracTor—known as the tractor that brought new accessibility and new economy to the crawler field. It is available with a wide variety of equipment.

International Harvester Industrial Power:

Powerful crawler and wheel tractors (gasoline and Diesel)
Compact small tractors to handle difficult jobs in cramped areas
Power with built-in equipment of great variety
Fixed power units (gasoline, kerosene, and Diesel), 15 h. p. to over 100 h. p. for a wide variety of utility
Engines for light duty, 1½ to 5 h. p.

● International Harvester standards of mechanical excellence, accessibility, operating economy, and nation-wide service—through Company-owned branches and well-established dealers—are the standards by which industrial power is judged these days. In every field where mobile and stationary power is needed, users have welcomed the crawler tractors, wheel tractors, and power units produced by the world's largest tractor builder. As a result, you see International Harvester Industrial Power wherever you go—and you find operators who are enthusiastic over its performance. Specific information will be supplied on request.

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Chicago, Illinois

INTERNATIONAL HARVESTER INDUSTRIAL POWER

International DIESEL Power

The International Diesel engine in the TD-40 TracTracTor and the PD-40 Power Unit makes remarkable savings compared to other forms of power. Its great economy is due to low-priced fuel, to the relatively small quantity of fuel it requires, to its high combustion efficiency, and to its low maintenance cost. Investigate the International Diesel, which starts as a gasoline engine and converts itself automatically to Diesel operation.



Heavy Trucks Haul Fill for Dam Embankment

BEACH CITY, Dam of the Muskingum Conservancy Project is located approximately equi-distant from the cities of Canton and Dover, Ohio, on Sugar Creek, a tributary of the Tuscarawas River which flows into the Muskingum River at Coshocton, Ohio. This project consists of an earth dam 1,500 feet in length and 60 feet high and 4,100 feet of dike. The dam is on a pervious foundation and has a saddle-type spillway. The flow of impounded water is to be released through two conduits and controlled by six 7 x 15-foot gates. The drainage area above the dam is 300 square miles and the storage for conservancy purposes will be 1,700 acre feet, while the flood storage will be 70,000 acre feet.

The contract for the construction of the Beach City Dam was awarded to Wm. Eisenberg & Sons, Inc., of Camden, N.J., on February 26, 1935, for \$843,514.10. The work includes 575,000 cubic yards of common excavation, 125,000 cubic yards of rock excavation and the placing of 957,000 cubic yards of earth embankment and 30,800 cubic yards of concrete in the outlet or diversion structure. The embankment is spread in 6-inch layers loose and rolled with a sheepfoot roller while wet with the proper amount of water to secure the maximum density of the material used. The slopes of the faces of the dam are 1 on 2 to 1 on 3 upstream, and the same downstream.

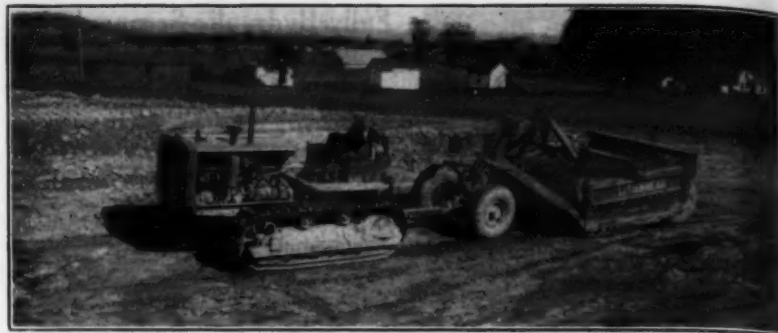
Trucks for Hauling

The outstanding feature of this contract is that the contractor chose to use heavy-duty trucks for all hauling to the embankment instead of the more common equipment in the other dams of this project. He leased a fleet of 16 heavy-duty Mack trucks from the Lenape Trucking Co., of Camden, N.J. In discussing this with other men, both contractors and engineers who have built large earth dams in other sections, there has been a great interest because of the possibility that with this fleet the contractor can move his material faster than with the other types of equipment.

For loading the trucks from the borrow pits which are sidehill pits, a distinct advantage from the standpoint of production, the contractor is using two Bucyrus-Erie 37B 1 1/4-yard shovels with short sticks. Also he had a Koehring 501 1 1/2-yard dragline which was used to cut the toe trench and then changed over to a shovel for loading trucks from more open borrow pits. Working three 5-hour shifts a day and with the average haul ranging from 1,800 to 2,000 feet, the outfit is averaging a production of 2,000 yards of embankment material per day from each shovel. Rock from a nearby ledge was shot, loaded, and hauled to the toe trench with three diesel tractors and 14-yard crawler wagons.

Shovels in Short Shifts Loaded Motor Trucks of Wm. Eisenberg & Sons on Beach City Dam, Ohio

On the embankment two Caterpillar Sixty tractors with LaPlant-Choate bulldozers are spreading the material into the specified layers and a Caterpillar Thirty with a Blaw-Knox Ateco sheep-foot roller is compacting the layers as spread. For the water to insure maximum compaction, a Jaeger triplex road pump is being used to pump from Sugar Creek. To keep the road in the best of condition for the fleet of fast trucks a Cletrac 20 patrol grader is used constantly.



C. & E. M. Photo
A 12-Yard Scraper Making the Cut for the Access Road to Beach City Dam

A 12-yard LeTourneau Carryall scraper was used to handle both cut and fill on the access road from one end while one of the shovels was making the cut at the other end. This unit was also used for digging 2,000 feet of channel relocation 50 feet wide by 12 feet deep. The larger scraper is also used to handle earth from the borrow pits where shallow cuts can be made

most economically and the material transported direct to the embankment in the body of the scraper and spread in the required layer without further bulldozing.

Watching the Gasoline

In order to maintain a constant check on the amount of gasoline used on the (Continued on page 36)

IT'S NEVER FAR FOR A BANTAM WEIGHT

REPAIR BROKEN CULVERTS
REPAIR SHOULDERS
EXCAVATE SHOULDER OF GRAVEL
DEEPEN DRAINAGE DITCHES
STREET SHOES

"Street shoes" are available and are easily attached to protect against damage from crawler treads. The Bantam Weight can travel on hard surfaced roads, soft roads, over bridges; most anywhere.

HERE'S an excavator made for maintenance jobs. Five minutes will see it on a trailer and off to travel safely over secondary roads and small bridges. The Bantam Weight's built like a streamlined train—high tensile alloy steels give it greater strength with far lower weight. All welded construction has simplified design, reduced inertia-losses, provided a digging cycle that's 'most as fast as a man can swing a scoop shovel. For a hundred highway jobs, the Bantam Weight's an ideal tool . . . so fast in getting to a job that it shrinks a county by miles . . . so fast in getting through a job that it means higher production per day's work. And at a price that's easy to fit into budgets. Send for information today.

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PH PACEMAKERS
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TAR KETTLES
Fire Proof—Oil Burning
Hand and Motor driven spray.
Many sizes. Write for catalog.

White Mfg. Co.
ELKHART INDIANA

County Roads Should Meet Local Needs

(Continued from page 1)

of earth road at an average elevation above the surrounding terrain of 1½ to 2 feet, with a 26-foot road top.

We have been fortunate in having considerable Federal funds available in the nature of labor. After casting up these roads, Fresno outfits have taken off the humps and equalized the earth on the top, giving us a road sufficient to meet the requirements of farm-to-market traffic. The advantages of this type of construction are: 1—It provides a nearly all-weather road. 2—It reduces to a large extent the number of culverts required to a mile. 3—It makes snow removal a less costly operation. In fact we find that today we are able to undertake snow removal, it costing only about one-quarter of the cost on a low type of road. 4—The taxpayer has been given twice as much for his money. These cast roads actually have been built for less money per mile than was spent on the older roads.

Federal Program Cramps Style

We are of course planning on enlarging our equipment by the purchase of one or two large powered scrapers when Federal relief labor is no longer available for finishing. During the last year we cast 80 miles of road, using an 80-foot right-of-way, and under the FERA and NRWR programs finished about 40 miles to a grade line. This year we are gravelling these projects under the WPA but are not making any great headway due to the inflexibility of the program.

The farmers are not permitted to work on the WPA. They are given relief through a resettlement program and of course, if not permitted to work out their relief in the winter, it is impossible for them to do so at all, the spring, summer, and fall being required for farming operations. It seems too bad that between 500 to 700 farmers in our county, who were willing and anxious to work on road projects that would directly benefit them, were prevented from doing so because of friction among three men sitting in Washington, each one being afraid the other would have more to say or more money to spend on this thing we call relief.

For the last two years there has been considerable talk by the Federal Government about farm-to-market roads. We had a sample of it under the NRWR program. In this state it was supervised by the State Highway Department and the Bureau of Public Roads. Both are very capable organizations and their standards of construction are the best. That is the fault. Farm-to-market roads are not to be construed as State or Federal highways and it is foolish and expensive to try to hold them to the same standards. The engineers that are sent out are accustomed to these standards and, regardless of whether it is the intention of the Bureau or not, they tend to follow their training.



For the Largest and Smallest Jobs

Write for Catalog describing the complete "Con-weight" line of dependable anti-friction, toughing and return idlers, trippers and accessories. They will measure up to the most rigid requirements of the largest as well as the smallest job.



PORTABLE MACHINERY CO.

Division of A. W. Farguhar Co., Limited

BOX C-1, YORK, PA.

Counties Should Direct Own Program

If the Federal Government desires to put over a farm-to-market road program they should go directly to the counties. A standard suitable for county roads should be set. Then the program should be supervised by the counties, eliminating the cost of elaborate plans and expensive finishing work. Farmers would then have accessibility to the State and Federal roads leading directly to their markets. This year in our state practically all Federal and State monies will be spent on primary roads. This is going to bring forth an awful howl from the farmers who have been paying taxes for so many years and who have as yet reaped only meager benefits from their road taxes. The counties are unable to do anything about it as they cannot bear the whole cost in these times and they cannot dictate where the Federal and State funds should be spent. Consequently the counties' funds will be absorbed by the Federal and State programs and little or no county work will be undertaken.

Heavy Machinery Trailers Conform to State Laws

Two new machinery trailers for hauling shovels, tractors, road rollers, and other contracting equipment have been announced by the C. R. Jahn Co., La Crosse, Wis. The new four-wheel trailer is designed for loads up to 12 tons, and the six-wheel unit for loads up to 18 tons. In both models the main beams extend the full length of the trailer and are shaped without cutting the top or bottom flanges at the front deck. The front deck is raised to clear the front wheels, permitting a full right angle turn.

The four-wheel trailer has a rigid-mounted rear axle while the six-wheel type has two independent oscillating-type axles which adjust themselves to the irregularities of the road. Both models feature the oscillating front axle, which eliminates the necessity of front springs and makes turning easier.

The mechanical internal expanding brakes are available for vacuum or air

operation. Over-sized taper roller bearings are used throughout. The loading height of each trailer is only 29 inches. The trailer width of 8 feet conforms with the highway regulations of all states. Either solid or pneumatic tires are furnished.

Front Power Control Unit

A front-end power control unit, designed for users who want a power unit that will operate angledozers or bulldozers and yet leave the rear of the tractor free for mounting winches or other equipment, is announced by R. G. LeTourneau, Inc., Peoria, Ill., and Stockton, Calif. This compact new unit is mounted at the front of the tractor and takes its power direct from the motor crankshaft through gears. It is operated from the tractor seat by means of a lever. The entire unit is built by electric arc welding of special alloy steel with no castings. Timken and Hyatt bearings are used.



Two-Stage Air-Cooled Portable Compressors

I-R was first to recognize the advantage of air-cooled construction for the compressor end of Two-Stage Portable Compressors.

All portables are in the last analysis air-cooled, even when the heat is carried away from both the compressor and the engine through the medium of water, for in reality the actual cooling of the water is accomplished by a draft of air created by the radiator fan.

The problem of cooling the engine is entirely different from that of cooling the compressor. The engine, to operate efficiently, should be kept at a temperature of about 180° F., which means hot water in the jacket. The compressor requires cool water to operate efficiently.

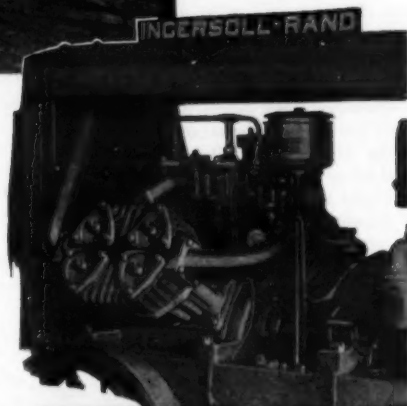
A compromise is made when both engine and compressor are water-cooled from one common system. With a common water cooling system, when the engine operates efficiently the water is too hot to properly cool the compressor, and if the compressor is correctly cooled, the water is too cold for efficient engine operation.

With the I-R Two-Stage Portable, water is used for cooling the engine and air for cooling the compressor, each of which performs its own duty correctly and represents the most efficient method for the purpose intended.

Vertical cooling fins on the I-R Compressor assist the cool air to rise to the top of cylinders. The intercooler fan draft quickly carries away the heated air, thus creating a more rapid heat exchange resulting in efficient cooling of cylinder walls and heads.

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SIZES

60A, 105, 160, 210 and 315
(Actual capacity at 100-lbs. pressure)
Gasoline, Oil Engine, or Electric-Driven.

(The first of a series of five advertisements).

1. Air-Cooled Compressors
2. Independent Cooling Systems
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MOUNTINGS

Units Less Running Gear,
Steel Wheels, Solid Rubber Tires,
Pneumatic Tires, I-R Trailer,
Two-Wheel Trailer,
Motor Truck Mounted.

Roads "Down Under" Equal Those of U. S.

(Continued from page 6)

oughly mixed and spread by power graders. Thirty-five miles of road were so constructed.

In Southern Australia the work of reconstructing to modern surfaces the main roads of the state continued actively, according to a specially contributed article in *Roads and Road Construction*. Although the amount of money expended was considerably less than that spent per year before the financial depression, the mileage of roads improved compares favorably with that of those previous years because much of the work done has been in sections where the low-cost types of roads was warranted by less traffic than is the case in the section around Adelaide where traffic is concentrated.

The Highway Department has consequently given considerable attention to various types of low-cost roads in which crushed limestone, crushed granite and gravel have come in for most favor. Where limestone is available, the method adopted is to scarify the old road bed, add such rubble as is required, roll and drag to obtain a well-formed balanced base, and on this lay about 2 inches of limestone crushed from 1 inch down. Traffic is then permitted to use the road and by a regular system of dragging, the development of pot holes and ruts is obviated and gradually a suitable base is obtained for a seal coat of bituminous material at a later date. Such a road is provided at a cost of about £750 a mile. In the case of gravel roads, practically the same procedure is adopted but as the gravel is less expensive than the crushed stone the cost per mile generally does not exceed £650.

The bituminous work carried out during the year was mainly reconstruction in bituminous macadam penetration, 41 miles; the surface dressing of roads previously laid down, 30 miles; and the resurfacing under the drag process with pre-mixed material of sections of existing bituminous concrete roads which were showing signs of wear.

A number of bridges were constructed or reconstructed and on roads under reconstruction not only curves and alignments were redesigned but bridges and culverts in poor condition were re-modeled or replaced to provide for adequate drainage of the road.

During 1935 the State of New South Wales embarked upon a program of improving road facilities by the construction of many new bridges. Among those completed during the year are the Boyd's Bay Bridge over the Tweed River, the Raleigh Bridge across the Bellinger River and the Morro Bridge, serving the north arm of the Clarence River. The Ryde Bridge in the Sydney area has given better access to many of the outlying suburbs. Work was also started on a number of important bridges on the Prince's Highway which will probably be completed in the course of this year.

New Zealand

The New Zealand road system is divided into two main categories for administrative purposes, the main highways and all other roads. Main highways are designated by governmental decree and are the principal arteries of commerce linking up the more important points. They are constructed and maintained by the proceeds of certain forms of taxation. Other roads are those giving access to isolated communities and farms, on which travel is not heavy and which are not of general importance individually to the communication system of the Dominion as a whole. Funds for these roads are appropriated from the treasury supplemented by payments from local bodies. They are constructed

at a minimum of expense and are non-surfaced as a general rule. They are constructed almost entirely by hand labor, particularly during the past two years.

New Zealand's road mileage is 50,930 miles or about one mile of road for each 2 square miles of territory. The total expenditure by the Public Works Department on the main highway system during the past year amounted to about £565,000 (a New Zealand pound in 1935 approximated \$3.91), £55,000 of which was received from local bodies and £150,000 from the unemployment fund. The expenditures of the Main Highway Board amounted to £1,070,000 of which £200,000 was devoted to construction, mostly improvements on existing road beds, and £870,000 for maintenance. The funds for the activities of the Public Works Department are secured from general taxation.

Estimates for expenditures during the current year 1935-36 are placed at £500,000 for construction and £875,000 for maintenance. In addition to these regular expenditures, about £1,000,000 has been paid by the unemployment fund and local bodies throughout the Dominion as a subsidy for their road and street work.

At the end of the fiscal year March 31, 1935, the New Zealand main highway system was comprised of 397 miles of unimproved earth roads, 9,495 miles of gravel and waterbound macadam, about 1,600 miles of surface-treated or penetration macadam, concrete and asphalt bituminous roads, and 66 miles of cement concrete. The balance of the road system is that of roads connecting isolated communities with main highways, which consist mainly of graded roads without surface improvements.

Road building materials and equipment are purchased whenever possible in British markets. However certain types of road building machinery are made only in the United States, particularly tractors and graders and considerable amounts of these types of equipment have been purchased from this country. The standards of road building, as in Australia, are very high. Many of their engineers have studied in England and the United States and there is no lack of competent engineers to carry out New Zealand's road building and maintenance programs.

British Pacific Islands

In all of the large group of small islands coming under British administration, the land area in square miles amounts to only about 23,035 square miles, with a road mileage of about 305 miles. The roads of these islands are not of an elaborate construction but suffice for the needs of the communities.

On the island of Mauru, mandated to Australia, the road mileage is negligible; Gilbert and Ellice Islands, a British Crown colony, are widely scattered and the roads were first made by early missionaries. They are of ordinary earth construction and do not require modern surfaces to take care of the little traffic which exists.

The New Hebrides Islands, British-French co-dominion, have 5 miles of in-

ferior gravel roads and some dirt and stone tracks, constructed by coconut plantation owners. The Solomon Islands, a British Protectorate, have a few dirt and stone tracks, constructed through the coconut plantations, and some ribbon tracks, that is, strips only for the wheels on each side. On Norfolk Island, administered by Australia, and on Lord Howe Island, a dependency of New South Wales, the road mileage is negligible.

French Oceania

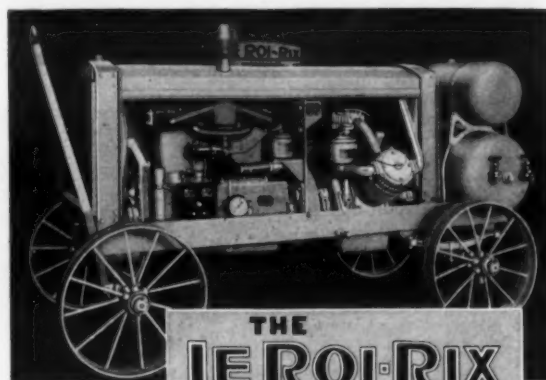
French Oceania consists of the islands of Tahiti, with 97 miles of road, Moorea with 37 miles, Raiatea with 35 miles and other small islands with 17 miles. Within the city of Papeete, Tahiti, there are about 80 miles of roadway, making a total of 266 miles for the colony. All the roads are either waterbound macadam or earth, sand and gravel com-

binations, more or less well rolled. Ground coral is used as a binder in most cases.

On the island of Tahiti, due to the increasing number of trucks and busses carrying freight and passengers, the highways are badly broken down and improved types of construction will undoubtedly be necessary in the near future. There is no automobile traffic of any importance on any of the other islands and the roads and bridges are designed to accommodate only the lighter vehicles. Jurisdiction over the highways of French Oceania is exercised by the Department of Public Works of the French Colonial Government, the chief of which department is an engineer with road and bridge building training.

Funds are allocated from the general budget of the colony and are spent by

(Continued on next page)



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AIR COMPRESSOR

OFFERS more for your money! Le Roi Valve-in-Head Engine, spring mounting, better cooling . . . just a few of many reasons why we can give you lower operating and maintenance costs, as well as longer life, in Le Roi-Rix Air Compressors. Available in single or two stage, portable or stationary, all mountings. Put your "air" problems up to us.

LE ROI COMPANY, Milwaukee, Wis.
Builders of Le Roi Engines and Le Roi Generator Sets.

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BULLDOZERS

Do what hundreds of prominent construction companies are doing on the big projects. Use the Bulldozer with direct lift. It operates without gears, levers, cranks or springs. Save repair bills on your tractor or bulldozer. Get instant, accurate blade control.

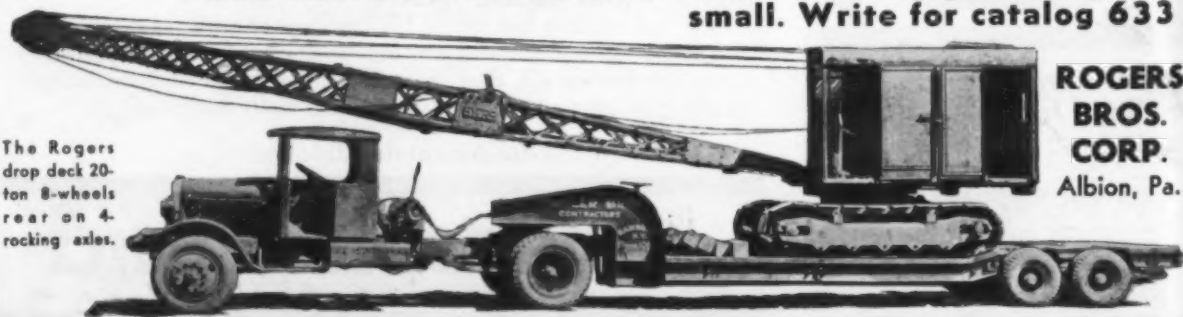
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Also Road Rooters, Scrapers,
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No hauling job is too difficult for a ROGERS TRAILER
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The Rogers
drop deck 20-
ton 8-wheels
rear on 4-
rocking axles.



**ROGERS
BROS.
CORP.**
Albion, Pa.

Roads "Down Under" Equal Those of U. S.

(Continued from preceding page)

the municipal authorities with the technical advice and approval of the Department of Public Works. Funds for road work are obtained chiefly from general revenues of the Colony which are derived almost wholly from import and export duties. There is a small annual vehicle tax, import duty on gasoline and a road tax levied on all male residents over 21 years of age, which are set aside as a special fund for highway improvements and repairs. The maximum vehicle tax amounts to about \$8.00 a year, and the tax on gasoline is 6 1/3 cents a gallon. The average annual income from these three sources is about \$24,000 a year. The funds for highway repairs have been greatly reduced and now the allocation amounts to about \$12,640.

British North Borneo

The area of British North Borneo is 31,106 square miles and the road mileage is 243, or one mile of road to each 128 square miles of area. As there are only 250 motor vehicles registered, the mileage would seem to be sufficient for their needs. There are 108 miles of unimproved earth and non-surfaced roads. 6 miles of improved sand, clay and gravel roads, 1 mile of waterbound macadam, and 128 miles of surface-treated and penetration macadam. The expenditures for construction in 1934 were \$103,752 and for road maintenance \$44,793.

Funds for road construction and maintenance are appropriated from the general fund. The road budget for the current fiscal year is \$102,799 for construction and \$56,026 for maintenance.

Asphalt is imported from Great Britain and Hong Kong and all road building equipment purchased is of British manufacture.

Hawaii

Hawaii's 400,000 residents own 50,000 motor cars, and more than 4,000 tourists take their cars with them to Hawaii each year, with the result that the islands are rapidly improving their highway system, according to information from the Pan-Pacific Press Bureau. Hawaii is extending the 200 completed miles of her 532 miles of Federal-Aid highway system by improving the other sections that were built before the system was laid out.

On a Federal 50-50 basis it is planned this year to spend \$1,218,000, while \$1,400,000 is available from Federal grants. This will be divided into 14 contracts on four different islands, ranging from a \$232,000 new road around Kaena Point about 50 miles northwest of Honolulu, to road widenings, bridges, grade crossings and even a \$10,000 landscaping project on the highways near Honolulu. While a majority of the projects are on Oahu, where Honolulu is located, some are on Hawaii, Maui and Kauai, the other larger islands.

Much of the work consists of realign-

ments, since the older roads were inherited from monarchical days before the islands became a part of the United States. Under the monarchy, construction work was limited and the roads followed the line of least resistance. Newer highways follow the general route of the older roads, however, some of which date back 200 or 300 years.

A spectacular project under consideration is a highway from Hilo to Kona across the Island of Hawaii. This highway, which would follow a trail blazed by American missionaries in 1850, would pass between the high volcanic peaks of Mauna Loa and Mauna Kea and cross a "saddle" that rises to nearly 10,000 feet above sea level. It would cut the drive between the two points by nearly 50 miles.

This would compare with the 45-mile link on Maui which connects the island's main seaport with the peak of Haleakala, a distance of 45 miles. This highway was built at a cost of \$1,760,000 to permit motorists to drive up 10,000 feet to an extinct volcanic crater.

This is typical of Hawaii's roads,



Pan-Pacific Press Bureau Photo

A Section of the Highway Around the Island of Oahu, Hawaii which are built largely for sightseeing | merce. Consequently Hawaii's roads are rather than to serve the needs of com- (Continued on page 34)



*to Get the Job—
and Handle It at
a Profit*

FORGET the OLD STUFF!

Figuring with Rex Pumpcrete and Rex Moto-Mixers—now standard tools of the concrete industry—instead of old equipment, got the Milwaukee Filtration Plant Job—and made it a PROFIT job.

These 21,000 yards of concrete—handled for 15c less per yard—with most of it going into walls and floors from 3" to 5" thick—

again proves "It Pays to Forget the Old Stuff."

Before moving it to this job, the owner of this Pumpcrete used it to pump concrete 105 feet in the air on malthouse construction.

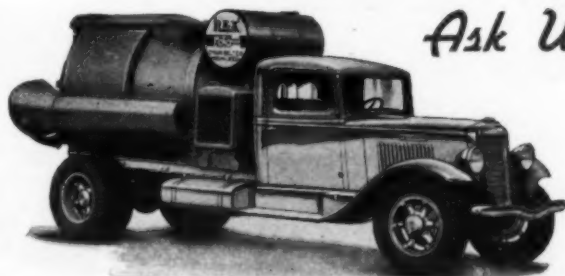
The Pumpcrete is an adaptable tool.

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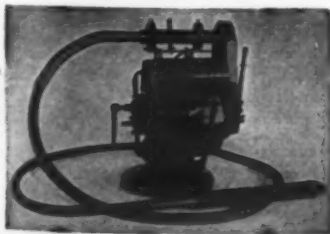
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Construction Equipment



Concrete VIBRATORS
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Write for Circular on types, sizes and prices

White Mfg. Co.
ELKHART INDIANA

Narrow Bridge Replaced by Overpass in Indiana

(Continued from page 15)

out for the concrete in the structure.

Blueprint Record Maintains Interest

The Project Engineer used a novel, but to him not new, method of maintaining the interest of the laborers in the work. His primary reason for the graphic record of progress was to furnish a quick-reference chart for his own use when reporting progress. The interest shown in such a chart by laborers on other projects led him to post the record where it could be easily seen by all the workers on the job. He took a blue-print of an elevation of the job and mounted it with thumb tacks on a bulletin board in a prominent place in his office. Each portion of the work completed was indicated on the blue-print with yellow crayon. Thus when the excavation for the abutments was complete the record showed the date and the amount of excavation. When the footings were poured the time, amount of cement, and the total amount of the pour were shown. This was watched with great interest by every man on the job and at the end was turned over to the contractor as a record of his work.

Personnel

Robert Moellering of the firm of Moellering Construction Co., Fort Wayne, Ind., contractor for this \$29,000 project, was in charge of the work. For the State Highway Commission of Indiana the work was under the direction of E. E. Caldwell, Project Engineer, and J. B. Manson, District Supervising Engineer.

Trucks Now Have Tires to Fit the Seasons

A year ago truck owners in the northern states would have ridiculed the idea that they could do without chains over snow-covered highways, and that the purchase of two sets of tires for every truck—one for summer use and another for winter use—would be economical. Many trucks have been equipped this last winter with the Pneumatic Lug type tire made by the Goodyear Tire & Rubber Co., Akron, Ohio. This tire has deep transverse bars or "lugs" that dig into mud or snow and provide the traction that answers the problems of winter driving in the North.

Operators running over secondary roads as well as state highways that are kept clear of snow know what mud and snow require of a truck tire. Chains for trucks are an expensive item because when they are used on hard-surfaced highways they go to pieces quickly. This problem and the need for extra traction on unimproved roads led to the development of this new Goodyear tire.

Kauffmann Heads Link-Belt

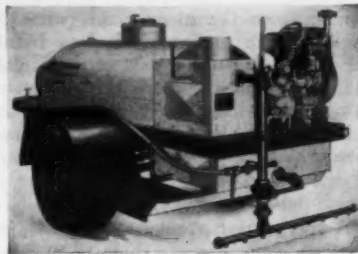
At the annual meeting of shareholders of the Link-Belt Co., Chicago, Ill., Alfred Kauffmann was elected President, succeeding George P. Torrence, whose resignation as President and Director of the Company was accepted by the Board of Directors.

Mr. Kauffmann started with the company 35 years ago as a draftsman. His career has included many responsibilities, such as designing engineer, superintendent of construction, sales engineer, vice president and manager of the Link-Belt plant at Philadelphia, vice president in charge of the Link-Belt Dodge and Ewart plants at Indianapolis, and for the past four years first vice president in charge of the company's Chicago plant operations. He was president of the company from 1924 to 1932.

A Bituminous Sprayer For Maintenance Jobs

The Littleford 101 utility sprayer was placed on the market by Littleford Bros., 485 E. Pearl St., Cincinnati, Ohio, in 1928 as a highway maintenance outfit and it has been constantly improved over the last seven years. It is now made in sizes from 300 to 800 gallons capacity and is usually mounted on pneumatic-tired trailers. It is equipped with an air-cooled engine and rotary pump. One or two Littleford oil burners with U-type return heat flues serve as a heating system. A pressure fuel pump is used on the latest models to supply fuel for the burners.

This machine has the advantage of enabling users to handle tars, asphalt,



The Littleford Bituminous Sprayer

emulsions, cut-back or road oils directly from bulk storage or tank car, eliminating package material. It is possible to operate as many hand spray bars as desired with control valves on the spray bar handles. It has a draw-off cock for filling pots and an aux-

iliary 4-foot spray bar can be used for applying bitumen when widening shoulders or relocating curves. It is also used to advantage for skin patch maintenance jobs or shoulder stabilization, where a pressure distributor would be too large and unwieldy.

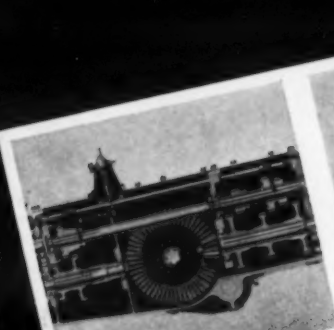
The No. 101 can be insulated with rock wool when required. Provision is made whereby standard models can be truck-mounted when desired. An operator's platform is provided at the rear. Large sizes are usually mounted on four-wheel trailers.

The construction of the fourteen dams and reservoirs in the Muskingum Conservancy District in Ohio involves the relocation of parts of nine railroads, 70 miles of tracks, and 150 miles of roads.

—The Highway Magazine.

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HIGHER SPEEDS

Allis-Chalmers established the current trend to lighter weight, higher speed tractors—which do more work per hour, and per dollar invested.



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Engine, transmission and tracks are rigidly bolted together as units—for greater rigidity, correct alignment, better balance, maximum strength.



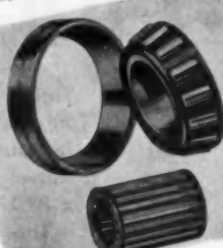
INSERTED VALVE SEATS

Exhaust valve seats have hardened steel inserts—more resistant to heat, corrosion and wear. Save grinding; save fuel—exclusive with A.C.



REMOVABLE CYLINDER SLEEVES

Separate, removable sleeves of tough nickel iron. Longer life. Greater cooling efficiency. No expensive re-boring—inexpensive to replace.



ROLLER BEARINGS

Instead of plain bearings or bronze bushings for truck rollers, front idlers, etc., Allis-Chalmers uses more efficient, wear-resisting roller bearings.



NICKEL STEEL HARDENED GEARS

Experience in the selection and treatment of metals for over three-fourths of a century enables Allis-Chalmers to produce the finest gears made.



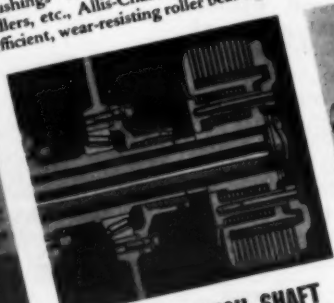
REINFORCED TRANSMISSION CASE

Exclusive design. Greater strength without excess weight. Easier servicing—makes working parts accessible without removal of adjoining parts.



CONTROLLED ALIGNMENT

The crank type stabilizer, exclusive with A.C., keeps tracks in perfect alignment—yet permits extreme flexibility. Saves track wear; absorbs jolts.



SPLINED CLUTCH SHAFT

The A.C. splined shaft is stronger and more dependable than the key construction commonly used. Steering clutches easily accessible.



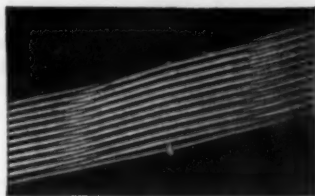
FIBRE TOOTH DISCS

No metal wears on metal in multiple disc steering clutches for satisfactory service, long minimum replacement.

A Highway Guard Strip of Longitudinal Wires

An exceptionally strong highway guard strip has been developed by the Page Steel & Wire Division of American Chain Co., Inc., Monessen, Pa. This Page Traffic Tape consists of twenty-one 11-gage hot-galvanized wires continuously woven alternately above and below half-round 9-gage hot-galvanized clips, spaced 6 inches apart, forming a flat tape approximately 2½ inches wide. The minimum tensile strength is 20,000 pounds for the standard tape and 35,000 pounds for the "hi-strength" type.

Two strands of Page traffic tape are usually sufficient for most roads. However, when desired, it can be installed



View Showing How Wires Weave Alternately Above and Below Vertical Clips

with three or four strands to give additional strength, visibility and protection. It is shipped on wooden reels containing 2,500 feet or 1,000 feet of tape. Two types of splices are available, one plain and one with a turn-buckle. To reduce post breakage from angle impacts, Page traffic tape is reg-

ularly supplied with offset fittings which hold the tape away from the posts. For use with three or four strands a single spring type fitting is supplied. The end fittings are of the wedge type and develop a holding strength in excess of the tensile strength of the tape.

New Air Compressor Catalog

A new 32-page catalog has been issued by Ingersoll-Rand Co., 11 Broadway, New York City, covering its complete line of 2-stage air-cooled portable compressors. In addition to giving complete details of the construction of these units, it is profusely illustrated with views showing the compressors at work on various road and contract jobs.

Stabilizing Earth Roads with Asphalt or Cement

(Continued from page 8)

soil at the rear of each scarifier tooth. After applying the asphaltic oil through the sub-oiler, the road surface is leveled with a motor grader and rolled with a 5-ton three-wheel roller.

The theory underlying this procedure is that if enough liquid asphalt is introduced at a proper depth beneath the surface of the roadway, it will permeate through the overlying soil, thus making it water-repellent and consequently stable.

Frank S. Gilmore, Highway Engineer of The Asphalt Institute, reports that these roads are now water-resisting and unaffected by rain. After prolonged dry weather the soil on the shoulders outside of the treated way becomes quite dried out and large shrinkage cracks appear. There is no indication of cracking or checking in the treated sections of the roadway. It is believed that emulsions should be better than liquid bituminous products for obtaining thin highly cohesive films of bitumen on very finely divided soils when applied beneath the surface.

Use of Cement with Clay

The third method of stabilizing clay-type soils is to add some chemical which will change the colloidal properties of the soil. A recent development which seems to change the colloidal properties of the clay and its resistance to the entrance of water is the use of portland cement in sand-clays and perhaps what might be classified as clay soils. In field investigations in South Carolina the cement was applied by means of stone spreaders over the surface of the road, at the rate of about two sacks of cement per cubic yard of dry soil. The cement and soil were then mixed dry until the mixture was of a uniform color. Water was then applied with a distributor and the mixing continued.

The most recent report from South Carolina shows that these experimental sections are in good condition and show no disintegration, but warn that no definite conclusions can be formulated as yet. The experiments do show that portland cement when mixed with certain types of soil will stabilize that soil to an appreciable extent, and that the addition of portland cement to clay practically destroys the plasticity of the clay. W. H. Mills, Jr., Testing Engineer, South Carolina Highway Department, states that methods of construction must be improved considerably before this type of soil stabilization can be used extensively. The method of applying the water and the method of mixing are not yet satisfactory. A mixing machine that would apply the cement and the right amount of water to the soil during the mixing operation would be much better than the methods used in these field experiments.

At the December, 1935, meeting of the Highway Research Board, Frank T. Sheets of the Portland Cement Association stated that the Association was working in its laboratory on soil-cement mixtures and that the results were promising, but that they were not in a position at that time to present any data.

It is evident that the stabilizing of the clay-type soils is in the experimental stage. Considerable advancement has been made with asphalt emulsions and portland cements in the last two years. It seems probable that as more and more trained minds become interested and work on the problem, valuable discoveries will be made. The progress of soils stabilization will be accelerated when commercial interests see more opportunities and more new ways to market their products.

A review of a portion of a paper on the stabilization of soil and gravel roads presented at the Thirty-third Annual Convention of the A.R.B.A.

DS THE WAY...

Controlled IGNITION

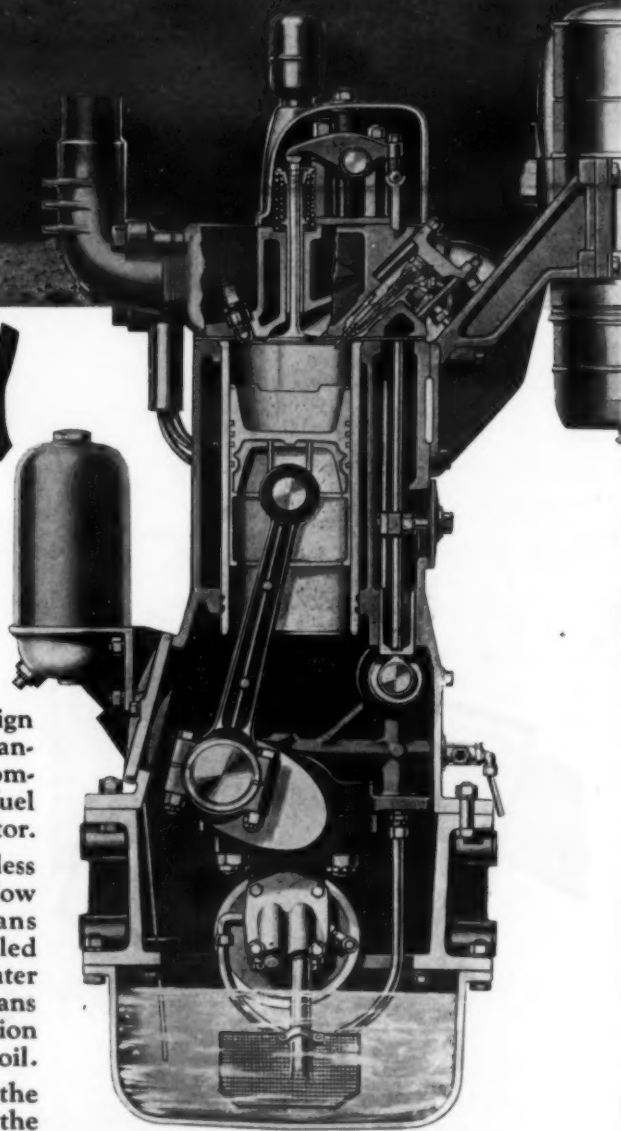
NEARLY every recent improvement in tractor design was pioneered by Allis-Chalmers. Now comes another outstanding advancement—the first tractor to combine gasoline engine simplicity and smoothness with fuel economy—the A-C Controlled Ignition Oil Tractor.

Controlled Ignition means smoother operation, less vibration and less maintenance—because of the low compression pressures. Controlled Ignition means instant starting, regardless of weather. Controlled Ignition means simpler design, less dead weight, greater flexibility, better balance. Controlled Ignition means power first cost and greater value. Controlled Ignition means efficient Controlled burning of Diesel fuel oil.

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ALLIS-CHALMERS OIL TRACTORS

TRACTOR DIVISION—MILWAUKEE, U. S. A.



Herrick of Iowa Runs Well-Organized Job

(Continued from page 14)

them. The fine grade was rolled with a Fordson tractor with loaded wheels to give the compression of a 5-ton roller.

Joints and Steel

Expansion joints were installed every 60 feet and contraction joints mid-way between. The expansion joints were 3/4-inch Elastite set with 3/4-inch x 2-foot dowels spaced 1 foot apart and welded to two 5/8-inch transverse bars 19 1/4 feet long. The transverse bars were spaced 8 inches from the joint on the side toward the paver and 6 and 14 inches on the far side. The dowels were capped with crimped metal caps on the side toward the paver. On this same side an extra transverse bar was located 6 inches from the single transverse bar on that side.

The expansion joint setter went over the 3-foot section caps which ran the entire length of the joint material. A sheet steel bulkhead held the pre-moulded joint material securely in place against the concrete.

The steel for the construction joints was the same as for the expansion joints except that there was no joint material and the dowels had no caps. On both the expansion and contraction joints the dowels were set 3 1/2 inches from the top of the slab with the transverse steel wired to them immediately below.

Transverse rods were set in the slab with metal chairs through which the rods were threaded. The rods were 5/8-inch x 12 feet and were set on 3-foot centers staggered from either side. They were wired to the longitudinal bars which were 5/8-inch x 30 feet. Two of these bars were set one on either side of the center line of the slab and one 9 inches from either form, and all 2 1/2 inches from the top of the concrete. When pouring concrete the transverse bars were successively supported by removable metal plates with long rod handles reaching to the forms. As soon as the concrete flowed under the rods and supported them, the temporary supports were removed and moved ahead.

A Littleford asphalt kettle was used for heating the material for filling the top 1/2-inch of the expansion joints which were hand poured.

Pouring and Finishing

At the Rex 27-E paver a man dumped the trucks and watched that the skip was clean on each trip. There were two men setting steel, two on the trail grader, two in the "mud," and two spading at the sides. The trail grader men placed and unrolled the paving tar paper of which there were seven rolls across the slab, lapped to give complete coverage of the grade.

An Ord finisher screeded the concrete and pulled a Flexible Road Joint Ma-

chine Co. center strip machine on the second trip over each newly poured concrete. A reel of center strip on the machine was run into the slot cut by the circular cutter on the machine. The longitudinal float men handled the center strip machine as well as their own 12-foot x 12-inch bull-float. They worked from a twin rolling bridge with the float.

Two slab finishers used 10-foot straight-edges, long handle floats and the two 10-inch belts. There were two curb builders with two men carrying back the concrete in "sedan" boxes on each side. A single joint finisher brought up the rear of the finishing procession.

Curing with Emulsion

Two men spread the burlap on the newly finished pavement and another sprinkled it for the 20 hours it was in place. Then the same men sprayed the slab with Curcrete, an asphalt emulsion, sealing the top surface against the loss of water. Because the sun heated the concrete so much when this method of

curing was used and caused undue expansion of the new slab the contractor white-washed the entire slab as soon as the emulsion had broken and dried. This was about 2 hours after the Curcrete was applied.

The specifications allowed this type of curing, the standard ponding or earth and water. The contractor chose the Curcrete as it was necessary to pump the water for the paver 7 miles and the additional burden on the line for ponding would have been too expensive.

Two C. H. & E. No. 11 triplex pumps were set up under one of the bridges on the project at the only stream where there was water.

Labor Hours

As this was an NRH project, the contractor worked the labor 30 hours a week. The shifts were 10 hours a day with the crews working the last three days of one week and the first three days of the next and then laying off seven days. When the work started last year the contractor worked two 5-hour shifts.

Personnel

This project F-376 in Polk County was completed by G. G. Herrick of Des Moines, Iowa, with E. J. Callahan as Superintendent. For the State Highway Commission, Don L. Teal was Resident Engineer, with offices in Des Moines.

Roads of African Republic To Get Needed Improvement

The few roads of Liberia, the only republic on the continent of Africa, are in a deplorable condition, owing to the depressed financial state of the government, and very little if any improvement has been made in the past few years, according to the U. S. Bureau of Foreign and Domestic Commerce.

However, a 3-year program has now been promulgated by the Executive and considerable progress should be made if funds become available. It is reported that only \$8,944 was spent for road construction in 1935 and about \$3,000 for maintenance.

BEAT CONTRACT DATES! CUT COSTS! AVOID BREAKDOWNS!

Modern Alemite Lubrication Helps Costly Equipment Take the Terrific Punishment of Today's Construction Schedules!



● Using an Alemite Service Gun to introduce valve plug sealing compound through Alemite Giant Button Head Fittings on a Rex Pumpcrete concrete pump. The Alemite Hydraulic System is provided for all bearing lubrication on this machine.

HURRY! HURRY! HURRY! The job must be kept to schedule! Men and machines are pushed to the limit—and beyond—keeping pace with the eternal demand for speed on vast construction enterprises. When men give way, other men are ready to step in. But when machines break down through inadequate lubrication—mounting penalties threaten!

That's why over 95% of today's construction equipment comes fitted for modern Alemite Lubrication! Here, for instance, is a Rex Pumpcrete—a concrete pump of the type used at Boulder Dam and the Mississippi River Project—ready to move 35 cubic yards of concrete per hour—to lift it 65 feet vertically, or send it 800 feet away horizontally!

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These fittings were selected because of their ability to receive a large volume of lubricant or compound in a short period of time. They can take the same kind of punishment the whole machine must stand—the kind any machine must stand on a modern construction project!

Mixers—tractors—shovels—graders—there's an Alemite System for every type of construction equipment—to help you beat contract dates, cut costs, and avoid expensive breakdowns! Be sure that every bearing—on every machine—is equipped with this modern insurance against lubrication troubles! The cost of replacing old-fashioned grease cups and other doubtful lubrication devices with modern Alemite fittings is too small to make a gamble worth while! Use Alemite Equipment, and know that the lubricant is reaching all bearing surfaces—forced there by Alemite's enormous pressure. Our lubrication experts are at your service! Write to us!

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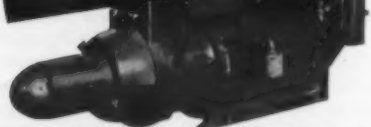
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Congress Considers Continuing PWA Projects

On March 10, Senator Carl Hayden of Arizona spoke before the United States Senate urging Congress to appropriate \$700,000,000 to continue local public works projects that have been partially or fully examined by the Public Works Administration. The specific projects which would be affected by such an appropriation are listed in Senate Document 183. Instead of asking for a blanket sum for the Public Works Administration, it is Senator Hayden's idea, as well as the view of other Congressional leaders, that a definite amount should be appropriated by Congress for the various separate projects which the Public Works Administration and the communities concerned consider as the most meritorious, and which have been submitted to the PWA for action.

The great advantage of Senator Hayden's suggestion is that a portion of the pending PWA projects are highway projects including bridges and viaducts. The proposal involves construction projects that have been approved already by PWA engineers and by the communities in which the projects are located, and in this way are definitely identified as useful projects. All of the work done under PWA is carried on by a contract system, thus helping contractors.

Manufacturers would realize benefits under this legislation, inasmuch as the construction would demand both materials and equipment. The work will provide much employment, both direct and indirect and thus contribute to the general improvement of conditions.

A New Economical Method of Screening

The Cedar Rapids-Symons vibrator screen, made by the Iowa Manufacturing Co., Cedar Rapids, Iowa, offers a large screen plant capacity, according to the manufacturer, because the screen is flat, the entire surface of the screen being in use simultaneously. It operates in a level position as the decks have a conveying as well as a screening action and the material is moved along rapidly and evenly over the entire surface of the screen.

The subframe of the screen consists of heavy channels to which are attached two sets of flexible inclined supports, one for the screen deck and the other for the side bars or balance deck which counterbalances the screen deck, the weight of which is carried, not on the bearings, but on these supports. The screen decks operate in an opposite direction to the heavy side bar counterbalances, thus obtaining a balancing effect which eliminates all lateral vibration.

For hot dusty materials, the screen may be completely enclosed with the exception of the driving unit. This runs on heavy SKF bearings which are tightly sealed against dirt and dust. This rotary power plant is also care-

fully balanced to eliminate rotary vibration. As the material moves in the same direction as the screen, the grinding and abrasive action on the screen cloth is minimized, resulting in longer life for the cloth.

These screens are regularly equipped with a feeder box which distributes the aggregates accurately over the entire area of the screen. This box is mounted on the heavy side counterbalances and has the same action as the main screen. Various feeding combinations may be readily set up.

For screening 1½-inch and under, the manufacturer recommends the Standard eccentric which requires a speed of 860 to 950 rpm, depending upon the nature of the material. Gravel requires less speed than sharp crushed stone which would ordinarily require 925 rpm. On larger sized material, there is a larger size eccentric which gives the screen a harder "kick" and with the larger eccentric the normal speed should be approximately 825 rpm. For extreme heavy tonnages, the maximum 1-inch throw

should be used and the speed should then be 750 to 775 rpm.

Nebraska County Fights Snow with Plow Made in Own Shop

(Photos on page 48)

Fillmore County, Nebraska, had its share of snow fighting this past winter, as the illustrations indicate. One of their major pieces of snow-fighting equipment is a huge plow made in the county road committee's own shop three years ago.

The plow was built entirely from scrap material, with the exception of the rivets and bolts, and is quite different in design from the standard plow, especially in regard to the lifts, runners, slope of the plow and the extreme forward mounting of the tractor into the plow, thereby eliminating side draft. It is powered with a Caterpillar Sixty tractor. This unit successfully broke through 8 feet of hard packed snow.



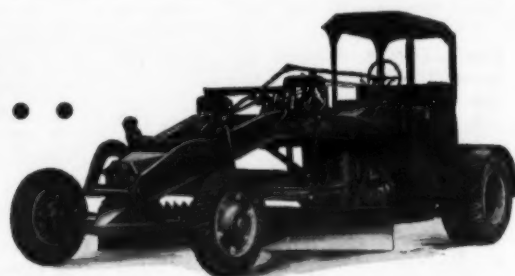
Fillmore County's Special Snow Plow

State Restrictions on Truck Sizes and Weights

A 53-page booklet of convenient pocket size has been issued by the Four Wheel Drive Auto Co., Clintonville, Wis., containing a complete summary of the state restrictions on the sizes and weights of motor trucks and trailers operating over the public highways. We believe that this booklet will be of interest to a large number of our readers so we take pleasure in recording its availability without cost from FWD.

A Long Line..

... of Road Machinery. In fact, the Galion line is almost thirty years long... with a Unit to meet any road building and maintenance requirement you may have. Some of them are entirely new... others have added improvements... combined, they give Galion the most efficient, economical and durable road machinery line ever placed in service.

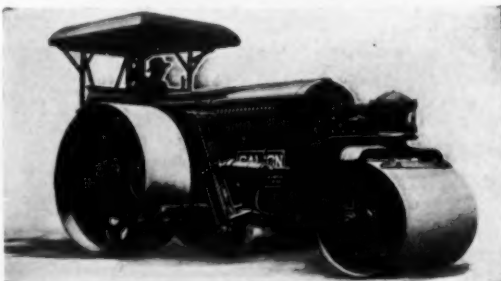


Galion Motor Patrol Grader with Hydraulic Control and J. I. Case power unit

Galion Looming Wheel Grader (right) with Hydraulic Control



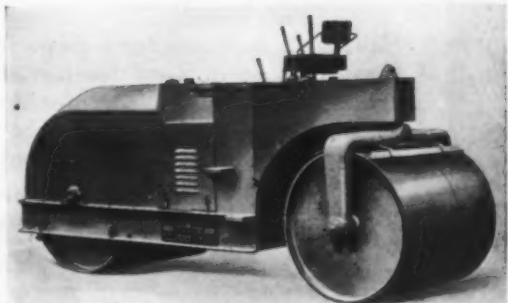
Galion Portable Roller—a low-cost versatile machine



Galion "Chief" Road Roller with "Roll-A-Plane" attachment



Galion No. 6 Road Planer



Galion "Variable Weight" Tandem Roller

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FORMERLY OF THE VANDERBILT HOTEL



One of the Electrically-Operated Shovels Loading the Belt Conveyor at the Florida Ship Canal

Belt Conveyors Moving Dirt for Florida Canal

(Photo on page 48)

Many types of dirt excavating and haulage equipment have been placed in service on the initial excavation near Ocala, Florida, for the 200-mile Florida Ship Canal which would make an island of southern Florida and connect the Atlantic Ocean with the Gulf of Mexico.

The Harvey-Ray-Noonan Construction Co., who received the award for about 2,000,000 cubic yards of excavation, is using a Link-Belt anti-friction belt conveying system about 800 feet long with a pivoted stacking conveyor for discharging the dirt to a spoil pile along the sides of the future canal. The dirt moves along the conveyor system silently and continuously all day long at a rate of about 12,000 cubic yards per day. It is excavated and delivered to the system by two Link-Belt electrically-operated crawler draglines working simultaneously, each equipped with a 50-foot boom and a 2½-cubic yard bucket. The spoil conveyor boom is about 85 feet long.

The conveyor system is semi-portable, being mounted on T-rail tracks, permitting it to be moved sideways very readily with the aid of tractors hitched to the conveyor structure, as the excavation progresses. Half of the width of the canal is excavated at first and the other half on the return trip of the conveyor system. The pivoted stack conveyor forms a spoil bank about 45 feet high. Belt conveyors of this type have been used previously in the building of levees and other flood prevention work.

Union of So. Africa Plans 5-Year Road Program

"All-Weather Roads Everywhere by 1938" is the new slogan adopted by the National Road Board of the Union of South Africa. While the four provinces of the Union have had highway programs for several years, the construction and maintenance of their roads have fallen behind the registration and use of motor vehicles. Accordingly in 1935 a law was passed providing for the Union Government to participate in the new construction of roads in the four provinces in the form of Federal Aid.

The program adopted is for a period of 5 years and calls for an expenditure of about £500,000, in the beginning, according to a report from the U. S. Bureau of Foreign and Domestic Commerce. It is hoped to increase this amount in the near future. During the 1934-35 fiscal year the Transvaal Province spent £663,000; Natal spent £225,000 and the Cape of Good Hope, £994,000. Data for the Orange Free State are not available. With the addition of funds from the National Road Board under the new law, the Transvaal budget for 1935-36 is increased to £892,000; the Orange Free State to £346,000 and there will be similar increases in the budgets of the other two provinces.

Greater use of road building machinery will be necessary for carrying out this program. Blade graders of both animal and tractor-drawn types are at present the principal equipment used, both for construction and maintenance. Tractors are used extensively for road construction.

Boye of Socony-Vacuum Again Heads Institute

The Board of Directors of the Asphalt Institute representing three-quarters of the asphalt producing industry of the United States and Canada re-elected B. L. Boye of Socony-Vacuum as President of the Institute for the fiscal year beginning April 1.

At the same time it was announced that the Allied Materials Corp. of Oklahoma City had been elected to membership with C. W. Barbour as its representative in the Institute Directorate.

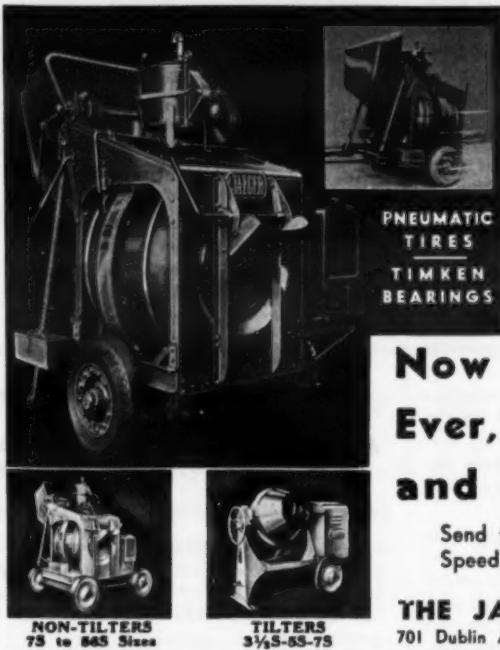
Other officers elected at the annual meeting were J. A. Blood (Standard Oil Co. of California), Vice President; Leroy M. Law (Shell Petroleum Corp.), Vice President; A. M. Maxwell (Standard Oil Co. of Ohio), Vice President; C. W. Bayliss (Barber Asphalt Co.), Chairman of Executive Committee; Herbert Spencer (Standard Oil Co. of New Jersey), Treasurer; J. J. Gartland (Texas Co.), Secretary. J. S. Helm of the Standard Oil Co. of New Jersey succeeded W. W. McFarland of the Warner-Quinlan Co. as a member of the Executive Committee and J. E. Pennybacker continues as Managing Director of the Asphalt Institute.

Colorado Road Building at Sub-Zero Temperatures

Road building in Colorado continued right through the winter in spite of sub-zero temperatures. Blanchard Bros., contractor for the relocation of Colorado State Highway No. 81 between Roggin and Wiggins, worked on excavation in a sandy soil which was frozen so hard that it worked like sandstone at 10 below zero. This PWA Project No. 74 consists

of 18.4 miles of light cut and fill work.

The contractor used two tandem hook-ups of LeTourneau 12-yard Carryalls, one single 12-yard Carryall and one heavy-duty roofer, all pulled by Caterpillar RD-8's. The tandem rigs, working on a 2,200-foot round-trip haul and hauling from both ends to the middle, made six round trips per hour to deliver 24 scraper loads or 192 yards per hour. The average loading time for these tandem units in this frozen ground was two minutes, or one minute per scraper.



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MODEL T-4 25 M.P.H.
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Few idle hours for your MICHIGAN Truck Shovel! Its speed, flexibility and stamina keep it working more hours per day—producing more returns per dollar invested... Rugged construction from the ground up. Quickly convertible to crane, clamshell, trench-hoe, backfiller, dragline and skimmer.

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Planned Blasting on Wisconsin Road

**Wm. Lathers, Jr., Worked
92-Foot Cut in Sand-
stone in 12-Foot Lifts and
Moved 4000 Yards Daily**

By R. G. BRODHEAD

(Photo on page 48)

THE old road between West Salem and LaCrosse, Wis., known as U. S. Highway 16, has become inadequate to meet the demands of the present-day automobile and truck traffic. To provide a wider highway, and to eliminate numerous short curves and turns, a relocation has been made that will insure faster and safer transportation over this section of beautiful rolling country in the upper Mississippi Valley. This section consisted of grading and draining 4.625 miles, of excavating 282,880 cubic yards of earth, borrow, marsh and channel, and 120,996 cubic yards of solid rock. The contract for Section No. 1, NRH Project 397B was awarded to William Lathers, Jr., contractor of Madison, Wis.

Well Equipped

Soon after completing some heavy grading between Mount Horeb and Blue Mound, Wis., Mr. Lathers' equipment was moved to West Salem and excavation started in June, 1935. The job was completed with unusual speed and efficiency, finishing in the latter part of November, in spite of a period of heavy going during the rainy season. This fine record was achieved by close supervision and by the use of modern equipment. The equipment included a Lima 801 2-yard shovel with semi-diesel engine, nine Hug trucks of 7-yard capacity, six Allis-Chalmers 75 tractors, one Caterpillar Fifty, five Continental hydraulic wagon scrapers of 7-yard capacity, a Schramm 360 compressor, a Cleveland D-12 wagon drill, an Adams power blade and Ingersoll-Rand and Gardner-Denver jack hammers.

Rock Excavation Problems

The rock excavation was in sandstone and included one through cut that was 92 feet deep and 220 feet wide at the top. This rock cut was reported to be the largest ever made in the state. It was large enough to dwarf the contractor's heavy equipment working on the lower lifts. Further, because of its size, design, and the nature of the rock, some interesting blasting problems were presented.

To preserve the slope of the cut, it was decided to excavate by drilling and blasting on 12-foot levels starting at the top. With the Cleveland wagon drill vertical holes were sunk 12 feet deep



The 2-Yard Shovel Working in the 92-Foot Limestone Cut

and spaced 6 to 7 feet apart along the face.

The explosives used were chiefly Her-

cules 40 per cent strength Extra L.F. gelatin, and Hercomite No. 5, both in 1 3/4 by 8-inch cartridges, this size being

the most suitable for the diameter of the drill holes. The extra gelatin was placed in the bottom of the holes, usually followed by the Hercomite. However, there was some variation in the consistency of the sandstone at different levels and when a greater spread of explosives was desired, without increasing the loading factor, Hercules No. 3 powder, a low-grade, free-flowing ammonia-type bag powder of 30 per cent strength, was loaded on top of the primer cartridges of extra gelatin.

The loading factor and drill-hole spacing were carefully adjusted to secure greatest overall efficiency. To keep the shovel in constant operation while working through the large cut, a factor of 3 cubic yards of sandstone to a pound of explosive was adopted. By using the heavier loads of dynamite, and increasing the drill-hole spacing, less drilling was required, and little secondary blasting. This procedure enabled the power shovel to work along steadily, keeping nine 7-yard trucks on the move,

(Continued on page 35)

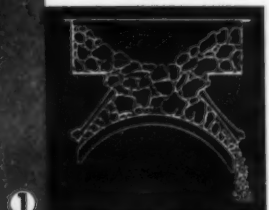
GREATER TONNAGE and a MORE CUBICAL PRODUCT

● Not only does the Tel Smith Gyrasphere increase tonnage . . . it turns out a more cubical aggregate which makes stronger concrete and better road material. The reasons—outstandingly superior features of Tel Smith design.

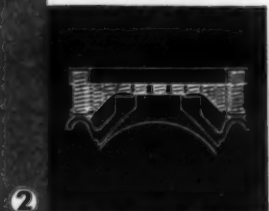
① **CHOKE FEED**—Fill the hopper up with rock . . . cover it up . . . pile it deep . . . Tel Smith takes an unregulated choke feed. That means steady, reliable, economic, effective reduction capacity.

② **SPRING RELIEF**—Springs relieve momentary packing and compensate for uncrushable material in the crushing chamber . . . allow finer adjustment.

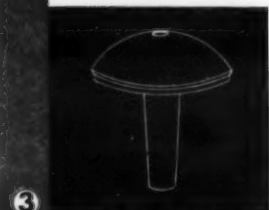
③ **SPHERICAL HEAD** and corresponding concave crush like an inverted mortar and pestle . . . rock being caught and broken between two multi-curved surfaces . . . causing an ideal cubing action. The spherical shape of the crushing head greatly reduces the lateral pressures, thereby relieving the load on the bronze eccentric sleeves. Diverted downward a large part of the load is concentrated on ④ **THE ROTARY HEAD SUPPORT** and roller thrust bearings. Head and shaft are supported on the eccentric by means of the upper roller thrust bearing while the downward pressures are transmitted to the frame by the lower roller thrust bearing (see sectional view) which supports the shaft. As both bearings rotate, wear is uniform and supporting surfaces are always perfectly aligned—shaft breakage is eliminated, eccentric bearings last longer.



1 CHOKE FEED



2 SPRING RELIEF



3 SPHERICAL HEAD



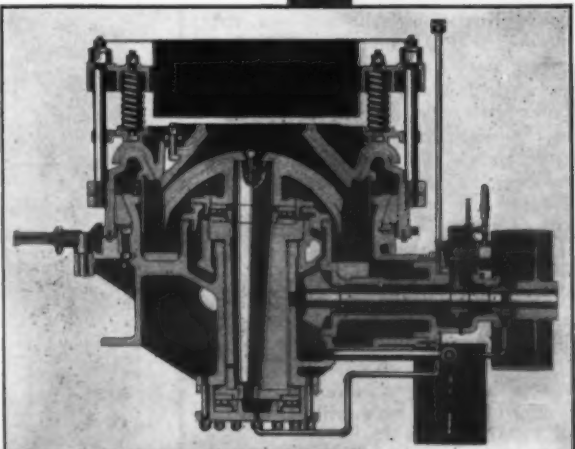
4 ROTARY HEAD SUPPORT

WRITE FOR BULLETIN Y-34 SMITH ENGINEERING WORKS

4014 N. HOLTON STREET MILWAUKEE, WIS.

Associates in Canada: Canadian Ingersoll-Rand Co., Ltd.
Montreal, Toronto, Winnipeg, Vancouver

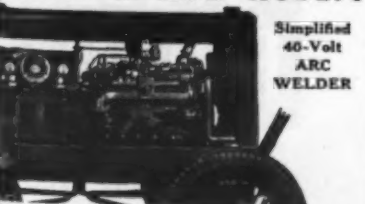
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605 Staller Bldg. Boston, Mass.	412 Westinghouse Bldg. Pittsburgh, Pa.	Brandeis M. & S. Co. Louisville, Ky.
L. V. Freley & Son St. Louis, Mo.	Milburn Mch. Co. Columbus, Ohio	Thomas G. Abrams Detroit, Mich.
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Sectional View
of Tel Smith
Gyrasphere
Crusher

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HOBART BROS., Box CE-46, TROY, OHIO

The Lubrication of Diesel Engines

The Choice of Lubricants Most Important in All Diesels Because of Range of Temperature and Speeds

IN the diesel engine, widely differing conditions of operation are encountered which affect lubrication. The diesel is not an easy engine to lubricate. Its different parts present different speed, load and temperature conditions, and each set of conditions presents an individual lubrication problem.

The most severe conditions exist in the cylinders where temperatures range from 250 degrees F. to as high as 2,700 degrees, and where compression pressures are around 500 pounds per square inch. Pressure is low between piston rings and cylinder walls, but speed is high and heat intense; yet the cylinder lubricant must take care of these conditions and at the same time form an effective piston seal to prevent gas leakage past the pistons and into the crankcase.

Maintaining the Piston Seal

Unless the oil seal is maintained between piston rings and cylinder there is an appreciable loss of pressure in the combustion chambers and misfiring or incomplete combustion results. These result in power loss aggravated by additional loss due to the coking of the unburned fuel which forms carbon deposits. These in turn eventually cause the rings to stick, creating further misfire and loss of power. Further trouble then results because of the possibility of a large portion of unburned fuel getting past the rings and into the crankcase, where acids may be formed and sludge created.

Since the temperature in the combustion chamber is high and above the flash point of any mineral oil, some people think that no oil can stand up, but the oil is not subjected to this high heat for any considerable length of time. In the slowest speed engines, the oil is exposed for only one-quarter second or less.

Cylinder Lubrication

With an increase in compression pressure on the upstroke of the piston, the temperature increases until the end of the stroke, when it is sufficiently intense to damage the oil. But at this point the piston shields most of the film.

The replenishing and wiping actions of the piston rings are vital in the maintenance of an oil film on the cylinder walls. During the compression stroke the wiping action of each piston ring builds up an oil wave at its point of contact with the cylinder wall, and each wave forms a seal against gases escaping downward. The seal may be broken at the top two or three rings if clearances are too great or pressures too high, but the possibility of blow-by is considered in the design and a sufficient number of rings are used to prevent it. Blow-by causes destruction of the oil film on the cylinder walls, due to the high temperatures of the gases.

Under these conditions it might appear that a heavy oil is desirable to maintain a seal and prevent film destruction, but this is only true in part. A very heavy oil is not so readily distributed over the cylinder wall as a lighter oil and, further, the heavy oil usually leaves more carbon when it burns. A light oil, being more easily distributed over the cylinder and piston surfaces, will effectively lubricate the parts, but it burns more easily than a heavier oil and it may fail to form as good a seal.

The amount of carbon left after burning is most important. Some of the carbon will be picked up by the oil on the cylinder walls and will be carried to the crankcase. Carbon particles, work-

ing into piston ring grooves, may cause sticking which will bring improper piston ring seal and loss of compression.

Greater cylinder wear occurs at the tops of the cylinders where the conditions of heat and pressure are most severe and the oil film is thinnest. Greater cylinder wear occurs, with a gradual reduction in wear toward the bottom. In time, the cylinder, worn to a taper, causes the piston rings to expand and contract as they adjust themselves to the taper. This causes added wear of the rings and grooves.

Cylinder lubrication is also affected by combustion conditions. If injection is delayed and maximum combustion pressure occurs over a large portion of the power stroke, the oil film is exposed to high temperatures for a longer period and, as a result, it may be partially or completely destroyed. Also, if a lean mixture is used during part-throttle operation, the excess air may burn the oil on the cylinder walls.

Excessively long idling or low load operation usually results in oxidation of fuel in the ring grooves, forming a gummy material which, on cooling, dries to a "varnish", sticking the rings.

The correct oil for cylinder lubrication is one that is light enough to distribute itself over the wall surfaces and yet adhesive enough to form an effective seal. It should leave little carbon on burning and have enough "oiliness" for lubrication when the film is partly destroyed.

Contamination of Oils

Diesel oils may become contaminated because of any one or all of the following reasons:

(a) Deterioration of the oil, causing it to break down; (b) Unburned fuel mixing with crankcase oil as a result of blow-by, thus thinning out the lubricant; (c) Dirty air entering cylinders through intake valves.

Even mineral oils of good quality form some carbon and oxidized products because of the high temperatures in diesel operation. These products accumulate in the crankcase in greater volume when an inferior oil is used, or when the viscosity is incorrect, or when piston rings leak.

Fuel characteristics have a bearing on oil performance. Impurities in the fuel, if not completely burned and carried out with the exhaust, will stick to the oil film and eventually get to the crankcase and contaminate the oil there. This condi-

tion will be aggravated if combustion is incomplete and unburned fuel mixes with the lubricating oil. Contamination of oil by the fuel is reduced by a centrifugal fuel purifier.

A common source of oil contamination and excessive wear is the air used for combustion. All air carries a certain amount of solid matter and in the course of a week a considerable amount will be drawn into the engine. Some passes out with the exhaust, but some sticks to the oil on the cylinder walls. Wear may be great, particularly in a dusty location, unless an air filter or a cleaner is used. As this condition may occur at irregular times, it is always well to be on a constant watch for it.

Cylinder Lubricating Systems

Splash and mechanical force feed are the two general systems used for cylinder lubrication. When a mechanical lubricator is used, careful control of oil feed to the cylinders must be maintained so that there will be neither under-feeding

nor over-feeding.

Bearing and Cross-Head Lubrication

Bearing lubrication in diesels does not present the difficulties of cylinder oiling. Connecting-rod bearings operate under moderate pressure at high speed and cross-head bearings under high pressures and moderate speeds. However, in piston-pin and cross-head pin bearings, instead of rotary motion there is oscillating motion which is not conducive to the maintenance of an oil film. Every reversal tends to destroy the wedge which creates the oil film, whereas a rotary motion would assist in the formation of an oil wedge.

Modern methods of oiling diesel bearings are:

1. Full pressure—a pump forces oil through passages drilled in the crankshaft, thence through drillings to the rod bearings, and up through drilled rods, hollow rods or tubes attached to the rods, to the piston pin bearings.

(Continued on page 32)

Modern Rollers for Modern Needs

*Include this New
Three-Axle Tandem*

BUFFALO-SPRINGFIELD

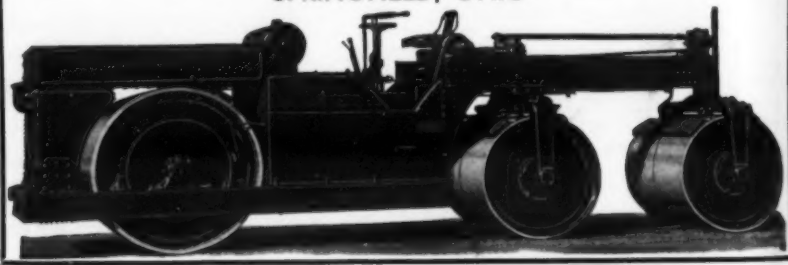
THIS is the roller that you have perhaps been waiting for—

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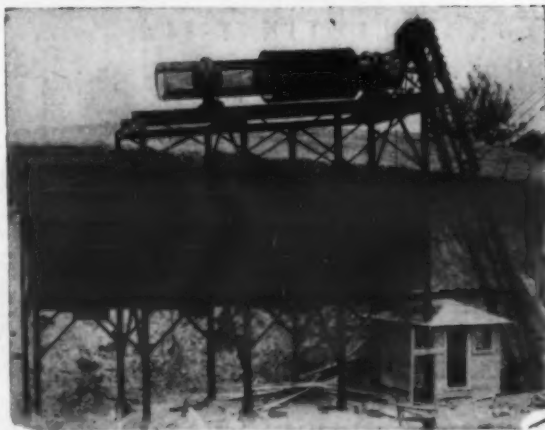
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(Fully described in illustrated circular)

THE BUFFALO-SPRINGFIELD ROLLER CO.
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Installation of combination screening and storage plant. Designed to meet any specification or local condition.

• Heltzel manufactures a complete line of portable and stationary bin and batching equipment, from 35 yard to any desired capacity —the result of over a quarter-century of specialized experience.

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Write for Bulletin 101

HELTZEL STEEL FORMS

for any type
of Concrete
Construction

THE HELTZEL STEEL FORM & IRON COMPANY
WARREN, OHIO • U. S. A.

Mixer Mfrs. Show Way to Equipment Economy

For twelve years the manufacturers of concrete mixers in the United States have engaged in a program of standardization which has been successful because it has been based on the sound principle of co-operation of the buyer and seller toward a common objective. In 1924 the Associated General Contractors of America adopted the recommendation of a number of mixer manufacturers that they co-operate in the standardization of construction equipment, to the end that the waste engendered by unrestricted competition in matters of sizes and design might be eliminated. The aim of this standardization was to provide the contractor with a definite measure of the capacity of competitive machines in mixed concrete.

The A.G.C. amended its by-laws and created the "Mixer Manufacturers' Bureau" as an affiliated unit. Practically all of the manufacturers in the industry joined the Bureau and subscribed to the principle of standardization.

The first Standards, effective October 1, 1924, eliminated the manufacture of all sizes of mixers and pavers except the 3½-S, 5-S, 7-S, 14-S, 21-S and 28-S in building mixers; 56-S, 84-S, 112-S in the larger size construction mixers, and 7-E, 13-E and 21-E pavers. The Standards provided for a definite bag batch rating for these machines and specified certain mechanical and accessory requirements for both the construction and paving mixers. Rating plates were furnished to be attached to those machines which complied with the Standards.

The 1924 Standards were far from perfect but everybody felt that a real step forward had been made. A Technical Committee composed of the chief engineers of representative member companies made studies and recommendations regarding the fundamental design, sizes, capacities and major mechanical features. Minimum and maximum drum volume ratios relating to size, at first thought impossible, were finally developed and incorporated in the Standards although considerable investment sacrifices by many of the manufacturers were necessary.

Beneficial results to the manufacturers themselves were immediately apparent. The energies of their engineering and technical staffs were turned to the constructive and stabilized plan of developing their machines along lines of efficient mixing action, consistent production and freedom from trouble and breakdowns in severe service. With the Standards fixed, service to the contractor became the keynote of design. The frenzied era of developing new models, sizes, and designs was at an end.

The end was not yet, for there have been eight successful revisions of the Standards in the past twelve years and the ninth revision is now in process.

Viewed as a whole, the net effects of the concrete mixer standardization program has been a substantial contribution to the economies of the construction industry. It has enabled the manufacturer to give greater value per dollar invested in mixer equipment. It has enabled him to provide the contractor with a more efficient machine with which to meet exacting demands of present-day concrete practice.

New Automatic Finisher for Bituminous Roads

The new Type D Jaeger-Lakewood automatic finisher, made by the Jaeger Machine Co., 701 Dublin Ave., Columbus, Ohio, is or can be equipped for finishing all classes of concrete and bituminous roads.

It is of unit construction throughout, the power plant, including gear cases

and controls, being mounted on a center section which is standard for all widths of finishers. The end trucks including the wheels are complete assemblies, facilitating width changes. The maximum width change adjustability of 2 feet is built into all standard machines. Additional width change parts for widths from 9 to 30 feet can be furnished.

The addition of vibration to the screed of the finishing machine increases its functional capacity to place and densify concrete. The number of vibrators, of 3,600 rpm, is based on the length of the screed, two for the 10-foot, three for the 20-foot and five for the 30-foot. Suitable size engines and specially wound generators are furnished to take care of this load.

Power is furnished by a 4-cylinder 23-hp engine with throttle control or, if desired, by a gas-electric drive. In the latter case, the main engine is directly connected to a generator which, in turn, produces current for three separate motors, one for traction and

driving screeds, one for lifting the screeds and the third for driving the tamping mechanism which can be furnished when specified or can be installed easily in the field.

A detailed description and specifications of this unit appear in Catalog PM 36, a pictorial review of Jaeger-Lakewood paving equipment, which readers of this publication may secure upon request direct from the manufacturer.

More Effective Control of Bulldozer Operation

The two hydraulic pistons for the control of the new Blaw-Knox bulldozer are mounted on the lever arms rising from the main frame of the bulldozer at either side of the tractor, giving greater leverage, and when extended to lift the bulldozer, the pistons also lift on the pusher frame.

The Blaw-Knox Co., 2067 Farmers Bank Bldg., Pittsburgh, Pa., uses two

gear segments for the gear reduction to increase the speed of lift. This helps keep the assembly low and retains the accessibility of the working parts of the motor as they are not covered by any portion of the bulldozer frame or operating parts at any time. By attaching the bulldozer frame only 5½ inches from the center of balance of the tractor, it prevents the tractor from being "nose heavy." The pivots of the pusher frame or side arms are directly below the drive sprocket hubs of the crawlers which are the only fixed points of the tractor. This prevents distortion of the bulldozer frame due to oscillation of the tracks on rough ground. The bulldozer proper has a curved bowl and side plates which make for easy moving of dirt and reduces spillage.

Twenty-five of the sixty-six dams in the United States, built or under construction, which are 200 feet above foundation or higher, are located in the state of California, and only fourteen are east of the Mississippi.—The Construction Advisor.

WHETHER weather or no, Bucyrus-Monighan walking draglines keep right on delivering big output at low cost. They don't mire down because, when digging, their ground-bearing pressure is distributed over the whole area of the base. The walking shoes are raised high off the ground, come down on fresh, unchurned sections when it's time to "walk" again. If an unusually deep muck hole is encountered, the shoes can be raised and turned to a new location, or supporting material placed under them. If you "weatherproof" your jobs with Bucyrus-Monighans, you will be "Singing in the Rain" with profitable, all-weather output.

Weather

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EXCAVATING, DRILLING, AND MATERIAL-HANDLING EQUIPMENT...SOUTH MILWAUKEE, WISCONSIN

Lubrication of Diesels Needs Special Attention

(Continued from page 30)

2. Scraping oil from the cylinder wall or cross-head guide by means of a scraper and leading it through a hollow pin to the bearing.

3. Registering the end of a hollow pin with an inlet port in the cylinder wall or cross-head guide, through which oil from a mechanical lubricator is ejected once per revolution.

Main and connecting-rod bearings are oiled by mechanical lubricators or by pressure circulating systems. Cross-head guides, because of the low unit pressures existing, are lubricated with leads from the mechanical lubricator or circulating system.

Valve Gear Lubrication

The valve operating gear—cams, rocker arms and bearings—may be lubricated either by spray from the connecting rods, or by submersion in an oil bath. Camshaft bearings may be oiled by splash, pressure, or by means of ring or collar bearings. Rocker arms are usually hand oiled. Valves operate at high temperatures and often carbon deposits on the stems, so that lubrication is more difficult than for the rest of the valve gear. Lubrication usually is provided only for exhaust valves in cages. Sometimes wick oilers are provided for these valves. Best results are obtained by using an even mixture of kerosene and engine oil. Water-cooled exhaust-valve stems do not present the problem of uncooled stems.

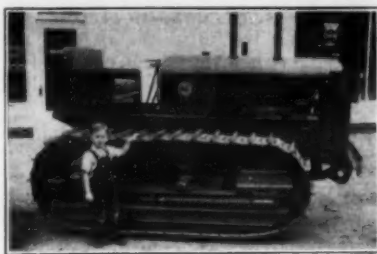
Fuel valves are self-lubricated by the fuel oil. This oil also takes care of the piston of the fuel pump. The fuel pump drive is lubricated in the same way as the valve gear.

Characteristics of Lubricants

In small engines the same oil may be used for cylinders and bearings. As the engine bore increases, the need exists for a heavier lubricant because of higher combustion temperature and greater clearances to be taken up by the oil film. In medium and large size units, cylinder oil should be heavier than for bearings, since a heavy oil in bearings increases internal friction. High viscosity oil is desirable for diesel service because such oils maintain a more nearly constant viscosity under both starting and operating conditions.

Rapid demulsibility is a desirable and important diesel oil characteristic. Water may get into the crankcase due to condensation of water vapor in the exhaust gas that blows by the piston rings, or due to condensation of water vapor in the air that passes through the crankcase breather or ventilator, or due to leakage from water-cooled pistons, or to leakage from cylinder water jackets, especially at cylinder liner joints.

The water mixing with the crankcase oil tends to form an emulsion which



Young Warren Chandler Starts Career as Tractor Operator at an Early Age

Youngster Demonstrates Easy Starting of Tractor

A 3-year old who stands only a few inches higher than the crawlers on the tractor recently demonstrated the easy starting of an Allis-Chalmers oil tractor at LaGrande, Oregon. Unaided, Warren Chandler of the house of Chandler Tractor & Equipment Co., started and stopped the 49-horsepower diesel fuel burning tractor more than forty times. All that was required was two or three shots of gasoline with a primer and the controlled ignition did the rest, without preheating of the combustion chambers or the use of an auxiliary gasoline engine.

New Series of Excavators with Electric Power

A new series of Ward Leonard electric excavators, with capacities up to 4 cubic yards, has been announced by the Harnischfeger Corp., 4419 W. National Ave., Milwaukee, Wis. In the design of these machines are two basic developments: new alloy steels, and arc welded construction to cut down inertia losses and speed up operations. Large members, such as the boom and dipper

acts as a binding agent for dirt, carbon, oxidized matter and so on, to form a sludge. The sludge may clog oil passages which in turn means anything from slightly increased wear to burned bearings, scored cylinders and other troubles that stoppage of oil flow may cause.

High flash point oils are recommended, because a low flash point oil is more readily consumed at high temperatures.

Oxidation is apt to occur in diesel oils because the high temperatures in the engine are conducive to this condition. Oxidation causes increased acidity and may also bring about precipitation of resinous or asphaltic matter which, combined with oil, water and dirt, creates sludge.

In those cases where diesels operate in cold surroundings "pour point" is important since it must be low enough to insure free flow of oil to the pump.

It seems hardly necessary in closing to mention the need for keeping oil levels correct and for using only the best quality oils.

We are indebted to *Esso Oil-Ways* for this discussion.

sticks, are of high tensile steel for lightness with great strength.

Special emphasis has also been placed upon weight reduction in the more scientific placement of machinery units behind the center of rotation to balance the front end, thus requiring less counterweight. Hoisting, crowding, swinging and traveling are powered by independent motors. All motors are synchronized for proper coordination and each is separately controlled by a push button from the operator's station. The swing speeds are increased to 3½ rpm and travel speeds to 1½ mph.

The new P & H Ward Leonards use a worm gear in the crowd mechanism for the first time in any power shovel. This is designed to eliminate brake wear and result in a fast, smooth crowding action which makes it possible to shake the dipper without strain.

Steering is accomplished through locking and clutching jaws on the

corduroys which permit the blocking of one side or the other for making sharp or gradual turns without the help of ground men. The jaws are operated by hydraulic cylinders electrically controlled from the operator's seat. Brakes and clutches are also hydraulically controlled, eliminating hand levers, pedals, etc. Splined shafting of high-grade heat-treated alloy steel is used.

TENTS
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Write our nearest plant today for catalog, samples and price list.

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BLAW-KNOX ROAD BUILDING EQUIPMENT

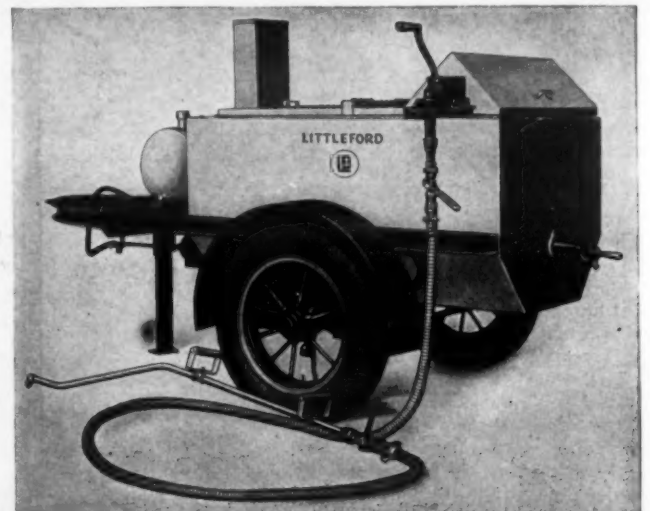


New developments and improvements in Blaw-Knox Construction Equipment are right in step with today's program.

With a background of years of practical experience, Blaw-Knox equipment is trustworthy. It is economical and low in maintenance. Designed to stand up under severe operating conditions, it is fitted to the job by skilled engineers. It helps immeasurably to fulfill contracts speedily and profitably.

BLAW-KNOX COMPANY
2067 Farmers Bank Building, Pittsburgh, Pa.
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BLAW-KNOX ROAD BUILDING EQUIPMENT includes: BATCHER PLANTS ROAD FINISH-SPREADERS (Manual or Automatic) TRUCK MIXERS BULK CEMENT PLANTS Trukmixer Loading Plants ROAD FORMS DIRT MOVERS BULLDOZERS STEEL STREET FORMS TAMPING ROLLERS ROAD FINISHERS (Gas-Electric) CONCRETE BUCKETS CLAMSHELL BUCKETS CEMENT TANKS STEEL BUILDINGS STEEL GRATING Literature on any of the above BLAW-KNOX Products will be sent upon application



DOUBLE HEAT CIRCULATION

Heat in the Littleford No. 84-HD Kettle makes two passes over the full length of inner melting tank... Every available unit of heat is absorbed by the melting bituminous material in the kettle...

Less fuel is used in this kettle by a margin of one gallon in every five than in any kettle not having this feature... Be sure your next kettle has "double heat circulation." The Littleford No. 84-HD has, in addition, an inverted V shaped screened reservoir, semi-elliptical spring mounting, heavy duty running gear, LB torch type burner and LB hand spray attachment... Write for full information and prices.



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Road Maintenance Equipment
SINCE 1900

LITTLEFORD BROS. 185 E. PEARL ST. CINCINNATI, O.

PORTABLE ASPHALT PLANTS TOWER TYPE

LARGE CAPACITIES
HOT OR COLD MIX

Accurate control of materials to comply with any standard specifications for bituminous mixtures.

Send for Bulletin T-248

HETHERINGTON AND BERNER INC

Indianapolis, Indiana

Overhauling and Repairing County Highway Equipment

By HARRY K. GOTTSCHALK
Road Supervisor, Allen County, Indiana

MUCH concern is shown over the requirements for materials and equipment for governmental units, but seldom is any attention given to the question of specifications for personnel. The specifications for a man may as readily and easily be outlined as any of the requirements of the U. S. Bureau of Standards for inanimate materials. This should be given particular consideration in the matter of employees in a highway garage and repair depot. The service required at these points is, in some measure, a sort of personal service, and the men selected should possess high mechanical qualifications and be executives as well. A well-manned highway garage and repair station will relieve the county engineer or road supervisor of much of the grief of conducting a county highway department.

A highway garage and repair department building should be well lighted, and special attention should be given to heating and ventilation. The buildings should be kept clean and orderly.

Shop Equipment

The following is a rather general list of necessary equipment and machinery needed in a highway department garage.

The repair shop work bench should be large and well equipped, located so that the maximum amount of light is obtainable, and should have racks and shelves adjacent to it for the convenient placing of the tools generally used.

There should be a lathe equipped for a general garage work. This lathe should not be less than 8 feet long, and have a swing not under 16 inches. This size will hardly accommodate all of the articles brought in for repair, but it has been found generally satisfactory.

A power drill or two is essential, as well as a screw press of sufficient tonnage for wheels, tires and gears, and likewise a grinding lathe equipped with Carborundum and sandstone grinders and brushing and polishing discs.

Certain large or special tools are necessary. Any mechanic worthy of the designation will have about all of the smaller tools needed. Lockers and cupboards for tool storage are necessary.

Cylinder boring and grinding equipment more than pay for itself, if the county truck fleet numbers more than a dozen. This will be particularly true if this rolling equipment is used for a number of years, as in most counties. Some of our trucks have been in use eight years and have traveled nearly a quarter of a million miles. We have found cylinder grinding and reboring about the only way to keep them on the road.

A blacksmith's forge and anvil are incidentals, but it is important to have on hand a complete stock of shapes and sizes in steel and iron. The cost of this material is insignificant compared to the benefits derived from having it on hand.

By all means, a garage for the overhauling and repairing of highway equipment must have an overhead traveling crane or chain hoist capable of handling at least a 10-ton load, and there should be a couple of A-frame hoists of varying capacities.

There should be a space partitioned off for the storage of spare parts and accessories. Truck and tractor parts which may be bought locally need not be stocked, but not many county garages are so fortunately situated and have to buy from supply stations located some distance away. Do not be afraid to buy, within reason of course, a large supply

Proper Shop Equipment and the Routine Servicing and Lubrication of All Trucks Lead to Savings in Operation

of the parts which require frequent replacement. If you fail to use them, some one in later years will find them useful, and the cost of a few extras is slight.

Gasoline, oil, and tires, should be kept under separate lock. Gasoline, particularly, has a high evaporation percentage when not securely housed.

Battery recharging and repair equipment will pay dividends.

The installation of an oil filter will be a source of saving. The use of filtered crankcase oil is becoming quite general, and is accepted as safe economy. It is well, however, to consult an authority before installing the necessary devices.

Routine Lubrication

One day each week, preferably towards the end of the week, trucks should be cleaned, greased, and the oil changed. The small amount of time needed for

this operation is unimportant, and the strict observance of this requirement will shortly become a matter of habit, and will likely become the largest single factor in keeping the equipment on the road in condition.

We favor a sort of military precision in the parking of trucks, tractors, and other rolling stock, when this equipment is put under cover.

From a paper presented at the Twenty-Second Annual Purdue Road School, Lafayette, Ind.

Make Your Own Tests

Lansing Pneumatic
Tired Barrow



for economy, with either or both of these handy helpers for builders, contractors, etc. F-25 barrow—capacity 4 cu. ft. wet concrete; K-4 Utility cart—6 cu. ft. dry material. Write for prices and details.



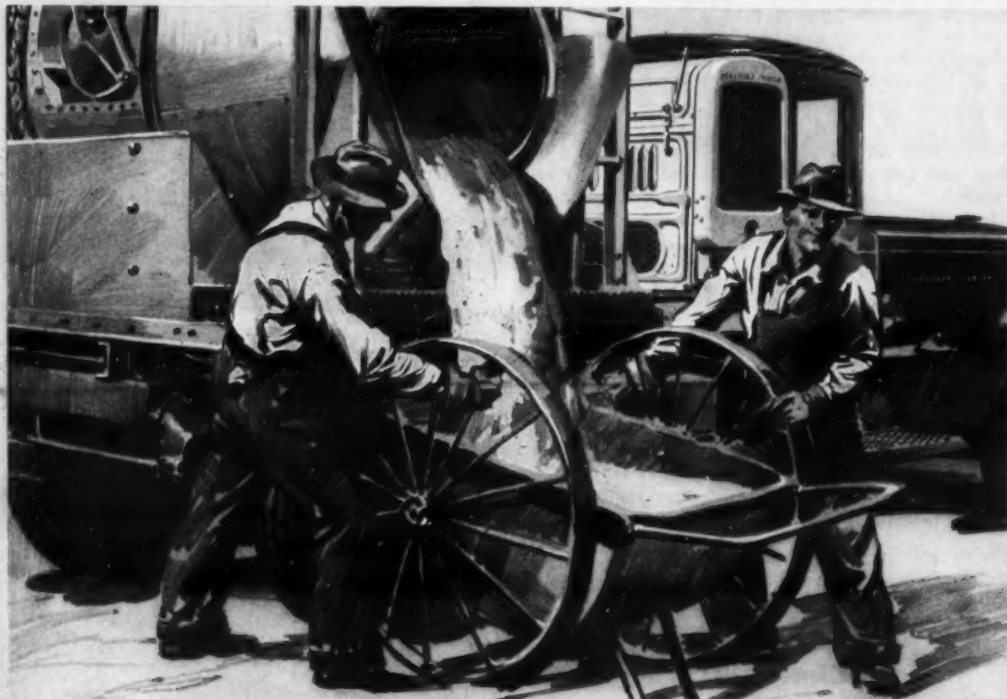
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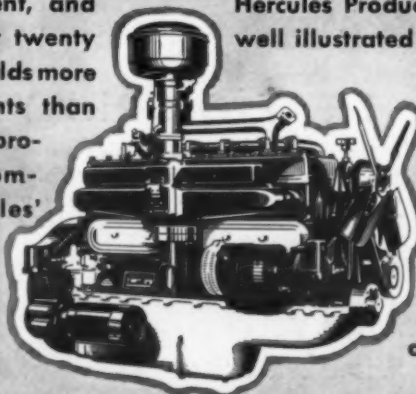
Lansing K-4 Utility Cart—with
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HERCULES ENGINES

REPUTATION—Hercules Engines have been building reputation among makers of heavy-duty equipment, and their customers, for over twenty years. Today Hercules builds more heavy-duty power plants than any other manufacturer producing only internal combustion engines. Hercules' reputation has been soundly built on the dependability and performance of its products



—and the experience and ability of its engineering staff. The regard accorded Hercules Products by manufacturers was well illustrated at the recent Road Show where approximately 49 per cent of all gasoline powered machinery used Hercules—and of the equipment exhibited in which Diesel engines were applied, Hercules Diesels were used in approximately 35 per cent.

HERCULES MOTORS CORPORATION, Canton, Ohio

America's Foremost Engine Manufacturer • Power Plants from 4 to 200 H. P.

Highways "Down Under" Equal Those of U. S.

(Continued from page 23)

mostly of light construction, asphalt and crushed rock, instead of concrete. Concrete was used in initial projects of the Federal-Aid system, shortly after it was laid out in 1919, but it was found that mainland specifications need not be applied to Hawaii because of the relatively light traffic there.

Requirements were changed also so that the Federal system need not serve interstate traffic as on the mainland, since Hawaii is not linked with states except by steamer. Instead, in Hawaii, Federal roads must connect seaports with national parks or be suited for military purposes. A \$1,000,000 military road is being built through Kolekole pass near Schofield Barracks with relief funds.

The Federal-Aid system includes 140 miles on Oahu, 254 miles on Hawaii, 75 miles on Maui, 56 miles on Kauai and about 14 miles on Molokai. On Oahu the main link is an 87-mile circuit of the island's principal mountain. The road climbs a valley back of Honolulu on an easy grade, drops down the abrupt face of the mountain on its opposite side, then runs up to the north end of the island and back to Honolulu on the opposite side of the mountain. Another unit circles the east end of the island while other units are designed to facilitate connections with the naval base at Pearl Harbor and the nation's biggest army post at Schofield Barracks.

Because Hawaii's coastal plains are cut by deep ravines, bridges are numerous. In many cases they are built to save traffic a circuitous drive into and out of ravines. Drainage is not a problem in most places, as the volcanic rock is so porous that rainfall is absorbed into the earth without running far from where it falls.

Besides bonds, Hawaii finances her roads with \$1,000,000 a year from gasoline taxes and a vehicle weight tax of 1 cent a pound. Motorists drive an average of 1,000 miles a month despite

physical limitations of the islands.

Area and Road Mileage

Country	Area Square Miles	Road Mileage	Area to 1 Mile of Road
Australia	2,974,581	468,251	6.4
British North Borneo	31,106	226	137.6
British Pacific Is.	23,035	350	65.8
Fiji	7,083	562	12.6
French Oceania and New Caledonia	10,966	186	58.9
Guam	210	66	3.2
Hawaii	6,449	3,095	2.1
New Zealand	103,862	50,930	2.0
Samoa (American)	76	30	2.5
Western Samoa	1,235	171	7.8
Total	3,158,603	523,867	6.0

The above statistics and most of the information on which this article is based and not credited to other sources were furnished by the U. S. Bureau of Foreign and Domestic Commerce.

Industrial Tractors for Hauling and Road-Building

Industrial tractors which may be equipped with dual pneumatics, single pneumatics, low pressure air tires, solid rubber wheels, or zero pressure tires, depending upon the service for which they are intended, are made by the Allis-Chalmers Mfg. Co., Tractor Division, Milwaukee, Wis. These I-U models come in a variety of wheel sizes to meet varying requirements of hauling, material handling and road building.

Power is furnished by a new modern Allis-Chalmers engine, features of which are removable cylinder sleeves of tough alloy iron that will not warp, inserted valve seats of long wearing tool steel, heavy drop-forged crankshaft, camshaft and connecting rods, air, oil and fuel filters, and dependable waterproof ignition. Positive lubrication is assured under all conditions by a pressure oiling system through drilled passages to all important bearings, piston pins etc. Cooling is accomplished by a four-blade 20-inch diameter V-belt driven fan, and a fin-and-tube type radiator of large capacity. Water is circulated by an efficient impeller pump.

Detailed specifications of the Model I-U tractors are contained in literature which may be secured direct from the manufacturer by mentioning this magazine.

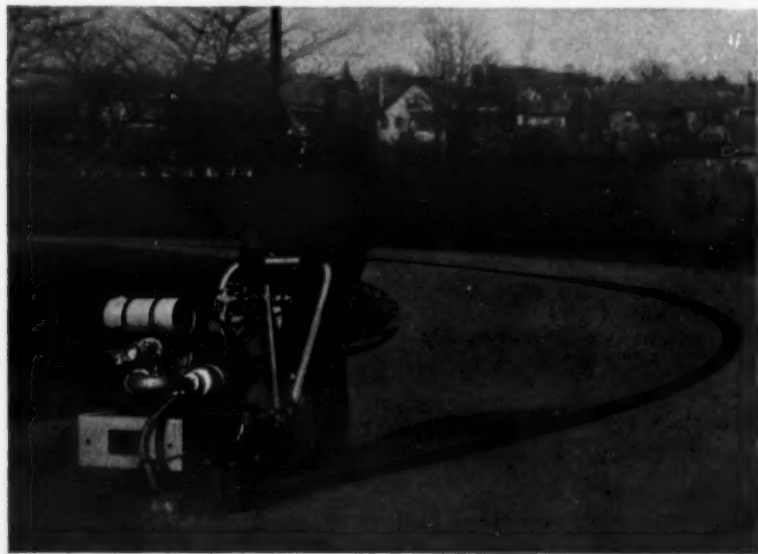
Road Roller Development

The development of road rolling equipment is a very interesting study. From Tresaquet (1764) through Telford and MacAdam we have developed the roller-type pavement of today. The early hand roller is still in use, the horse roller was replaced by the steam roller about 1860, first in France. Incidentally, the stone crusher was introduced at about the same time. And from this time the scientifically graded, and later the bitumenized, type road took its start.

The 1-cylinder steam roller was followed by the two—and then came the gas roller, first 1-cylinder, then 2 and now 6; also the diesel and oil-powered rollers. Manufacturers have attempted fundamentally, according to H. S. Perry, Assistant Chief Engineer, Bureau of Maintenance, Ohio State Highway Department, in his paper presented before the American Road Builders' Association Convention, to develop the roller so as to eliminate vibration, prevent

stop and horizontal thrust, commonly called shoving, to secure continuity of operations, and an adequate single-plane pressure. There are in use approximately the following number of rollers in the United States: New England states 1,450, Pennsylvania 1,150, New York 1,100, California 800, Ohio 750, all other states 7,500; also United States export 1,500.

As everyone has been informed any number of times, Boulder Dam is the highest dam in the United States, being 727 feet high, but fewer people know some of the interesting data about some of the other dams. Conchas Dam, in New Mexico, is the longest dam, being 5 miles in length. The shortest dam is Shoshone in Wyoming, an arch 328 feet high and only 200 feet long. The largest in volume will be Fort Peck, which will contain 100,000,000 cubic yards of earth and the most expensive will be Grand Coulee, in Washington, which will cost \$113,676,000.—The Construction Advisor.



THE LITTLEFORD TRAF-O-SPRAY

Traffic lines spray painted by the Traf-O-Spray are neat, uniform, penetrating. No hand retouching is necessary on any hard surface—rough or smooth. The hand gun is quickly removable for any

other spraying or painting operation you might have. Machine is precision built yet light, short coupled—easy to handle. Write for prices and bulletin L-9.



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ON EVERY SINKING JOB—
Gardner-Denver Sinkers Give More
Footage Per Shift . . . Every Shift

If you buy sinkers to get more work done, you'll buy Gardner-Denvers. Job experience shows that no other line gives you such an outstanding combination of great drilling capacity and freedom from maintenance expense.

GARDNER-DENVER CO., 102 Williamson St., Quincy, Ill.

GARDNER-DENVER

Blasting 92-Foot Cut on Wisconsin Road

(Continued from page 29)

and obtaining a full production each day. With an average haul of 1,800 feet for the excavated sandstone, the average quantity of earth and rock handled was 4,000 cubic yards in a 10-hour working day. There was, incidentally, an over-run of about 40,000 cubic yards of borrow for fill, above the original estimate.

Contractor's Camp

A noteworthy feature of this, and in fact of any Lathers' job, besides the modern equipment and the satisfactory results achieved, is the contractor's work camp. The camp wagons for the men who made up the regular crew are electric lighted, clean, and unusually comfortable. Set up in a grove of large trees, windows shaded with awnings and decorated with attractive flower boxes, the group of trim, neatly painted camp wagons resembles the cottages of some country resort more than a temporary work camp.

Equipment, of course, is also cared for well. The camp included a blacksmith and repair shop on wheels, and canvas enclosures for sheltering mobile equipment from inclement weather.

Personnel

Mr. Lathers who followed this contract with another heavy grading job—the Cross Plains-Spring Green road, practically a relocation of U. S. Highway 14, with much solid rock excavation—gained an enjoyable reputation on the work just described. When the second section of the new highway, now under construction, is completed, and the pavement laid, another fine modern highway will be available for the motoring public. The work on NRH project 397B described in this article was done under the direction of Division 5 Office at La-Crosse, Wis. T. M. Reynolds is Division Highway Engineer and A. E. Spooner was Resident Engineer on this project. We are indebted to the Hercules Powder Co. for the illustrations for this article.

New Hand-Power Hoist That Can Pull or Lift

There is always a place in a contractor's tool box for a handy tool that can help out on all kinds of jobs in emergencies. The Pul-Lift made by The Yale & Towne Mfg. Co., Philadelphia, Pa., is made as a 3/4, 1 1/2, 3 and 6-ton capacity hoist operated by means of a ratchet which actuates a lifting sprocket. The ratchet lever has a universal action so that it may be operated at any point in a complete circle. It is ideal for



The Yale & Towne Pul-Lift

riggers and is designed to operate in close quarters. Used as a 1 1/2-ton or in larger capacities, the operating mechanism includes an intermediate pinion and gear. The load brake is of the Weston screw and disc type and is self-actuating, so that it automatically sets and holds the load at any point.

The load chain is a special design free-rolling roller chain with links, rollers, bushings and pins all of heat-treated steel. The hooks are of drop-forged steel, heat treated and designed to open slowly without fracture under severe overload.

Denmark Plans Long Bridges

The Danish Ministry of Public Works has received from three engineering firms proposals for the construction of two of the longest bridges in the world, according to the *Municipal Journal & Public Works Engineer* of London. One bridge, to be about 9 miles long, would link Denmark with Sweden; the other, over 10 miles long, is part of a scheme to construct a motor road linking Copen-

hagen with Esbjerg, on the western coast of Denmark.

It is estimated that the total cost will be about \$112,000,000.

A Tennessee County Engineer suggests a 10-year WPA program for improvement of rural roads in an article which will appear in our May issue.

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ROAD BUILDER
 One-Pass Mixing — Better than 10 Passes of a Blade.

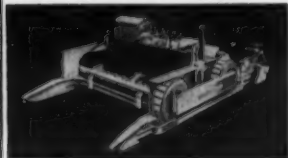
Up to 4 Miles a Day of Better Mixed, Longer Lasting, Smoother Roads — BIG SAVINGS on Stabilized or Retread Work!

JAEGER BITUMINOUS PAVER

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Three Florida Canal Contractors Choose **LETOURNEAU**



C. G. Fuller's 12-Yard Carryalls make complete 1,400-foot round-trip cycles out a 10% ramp in 5.5 minutes. The grade here is 27%.



Hooper Construction Company moves heaped loads out a 12% ramp with the tractors in third gear. Average time for 1,250-foot round-trip hauls is 7 minutes.

(Below) Benjamin Foster's four 12-Yard Carryalls moved 10,000 yards daily on a 450-foot one-way haul. Over adverse grades of 14% on a round-trip haul of 2750 feet, this ingenious tandem hookup of two RD's, the 24-Yard and 12-Yard Carryalls made complete cycles in periods ranging from 11 to 13 minutes, moving 31.3 yards to the trip.



A Le Tourneau 12-Yard Carryall Scrapper was the first mechanical unit to move earth on the Trans-Florida Canal. So well did it move the earth that three of the successful bidders on the canal are now using Le Tourneau Carryalls, cutting costs as they cut this biggest of ditches through Florida sands. Their experience—more yardage at less cost—is typical of Le Tourneau performance the country over. Ask your tractor dealer to show you what Le Tourneau equipment can do for you.

R. G. LETOURNEAU, INC.

PEORIA, ILLINOIS STOCKTON, CALIFORNIA

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Manufacturers of: Angledozer, Buggies, Bulldozers, Carryall Scrapers, Cranes, Drag Scrapers, Power Control Units, Rooters, Semi-Trailers.

Bridge Rail Installed by Arc Welding

A Total of 500-Plug Welds and 500 Fillet Welds Required to Secure Railings on 1,260-Foot Steel Bridge in Cleveland, Ohio

(Photo on page 48)

THROUGHOUT the construction of the new open spandrel, steel-arch bridge on the Lorain Road, Cleveland, Ohio, one of the assignments of the welding operator in putting the finishing touches on this smooth-lined steel bridge was to install the guard rails.

The welding of these railings comprised a small part of the total weld footage on this bridge; nevertheless this feature is of interest.

Sections of guard rail, 18 feet 3 inches long were supplied, prefabricated. These sections each comprise four ornamental malleable iron parts, held in a shop-welded steel framework. The ends have a channel cross-section, designed to fit between steel ribs on the posts which extend up from the bridge floor structure. At the center, each section has an intermediate post which is supported on a steel plate; this plate is held down by bolts imbedded in the concrete of the sidewalk.

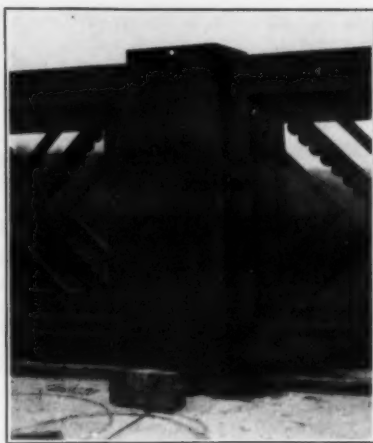
Putting Guard Rail in Place

The first operation in securing the railings was to "fit them up," by raising or lowering the ends to the desired elevation as indicated by a transit. Flanges of the railing frames were shop-drilled in four locations to accommodate plug welds. It was, therefore, a simple matter to weld the railing sections to the posts, it being merely necessary to run a bead around the edge of the hole, fusing the frame flange to the rib of the post. Each hole was filled up flush so that after the railing was painted, the surface would be perfectly smooth, and the weld unnoticeable.

The intermediate posts were joined to the bolted-down, 8 x 6½ x ¾-inch steel plates by fillet welds on all four sides of the post.

A total of approximately 500 plug welds and 500 fillet welds were required to secure the railings on both sides of this 1,260-foot bridge.

In all of this work, as well as in the preceding welding used in the erection of substructure towers, arches and floor stringers, the Lincoln shielded arc weld-



Plug Welds Join the Railing Sections to the Posts

ing process was used.

Personnel

The Lowenshon Construction Co., was general contractor for this bridge, and The Peoples Steel Co., steel erector. Shop fabrication was done by The Fort Pitt Bridge Co. All work was under the supervision of the Ohio State Department of Highways.

Heavy Trucks Haul Fill for Beach City Dam, Ohio

(Continued from page 20)

job and by each piece of equipment the contractor has installed a double Erie gasoline meter well protected from the weather by a wooden housing large enough to permit a man to move about from one side to the other. There is a hose and indicator on each side and also thumb-tacked to the inside walls on each side is the daily record of gasoline dispensed, giving the name of the driver, the piece of equipment and the amount of gasoline taken. Under this is a carbon paper and the sheet for the duplicate copy for the office records.

Personnel

The Muskingum Conservancy Project is in charge of Major J. D. Arthur, Jr., Corps of Engineers, U.S.A., as District Engineer with Theodore T. Knappen as Chief of the Engineering Division. The Beach City Dam is in the Dover Area, Capt. A. C. Lieber, Jr., Area Engineer, and N. R. Moore, Resident Engineer. For the contractor the three members of the company, all sons of the original owner, William Eisenberg, are on the work. They are Harry Eisenberg, President; A. Eisenberg, Vice President; and I. Eisenberg, Secretary and Treasurer. W. R. Buie is Superintendent.

Dynamite and Tractors Build New Park Roads

In September, 1935, a contract was awarded by the Colorado State Highway Department to Lowdermilk Bros. of Denver, Colo., for the construction of a section of the main entrance road in the Rocky Mountain National Park. This Federal-Aid Project 9-R-3 is only 1½ miles long but the low-bid figures with structures totaled approximately \$150,000. Lowdermilk's contract called for the building of the highway through a Box Canyon section of the big Thompson Canyon entrance and through the backbone of the Rockies. This meant drilling, blasting and plenty of rock moving.

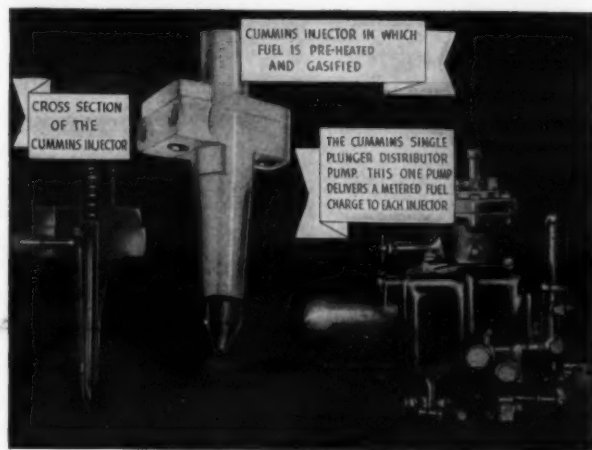
Air for the operation of drifters which were used instead of the usual air hammers was furnished by a 3 year-old-Cletrac upon which was mounted a 470 Gardner-Denver compressor run by a power take-off through V-belts. A structural steel framework was built up

on the rear of the tractor-compressor unit for mounting the drifters for drilling into the Canyon wall at the correct height. Holes were drilled from 20 to 24 feet to give maximum effectiveness to the dynamite.

In one shot 68 of these holes containing about one ton of dynamite liberated an unusually large volume of rock which was loaded by shovel into 4-yard trucks. Hauling out the rock was both slow and difficult because it was impossible for the trucks to turn around and they had to be backed in all the way. The roadway was kept reasonably clear for the fast operation of the trucks by a Model 40 Cletrac diesel with a trailbuilder.

Under a law passed in January 1935, 15,000,000 pesos have been added to Argentina's general fund for highway construction under a 3-year program of improvement. The National Highway Board has been authorized to contract for ten projects on roads and bridges which will absorb the allotment.

Read the record



No Diesel can be any better than its fuel system

You owe it to yourself to know why the exclusive Cummins Fuel Distribution System guarantees a smoother running Diesel . . . to know why the principle of using one, low-pressure pump to accurately meter each fuel charge gives the maximum in Diesel economy.

You owe it to yourself to learn how completely the fuel oil is cracked and gasified in the Cummins injector before it reaches the combustion chamber; to know why this assures progressive burning, smooth running with no explosion knocks and a clean exhaust.

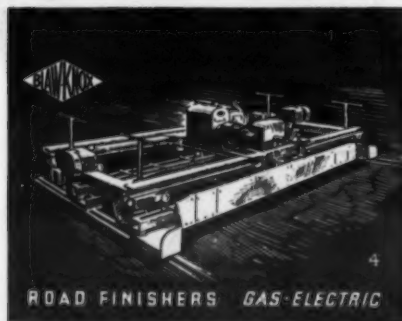
Ask any Cummins dealer for the new folder which describes the exclusive Cummins Fuel Distribution System or write direct to the Cummins Engine Company, 603 Wilson St., Columbus, Indiana.

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INDUSTRIAL AUTOMOTIVE AND MARINE

DIESELS

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New developments and improvements in Blaw-Knox Construction Equipment are right in step with today's program.

With a background of years of practical experience, Blaw-Knox equipment is trustworthy. It is economical and low in maintenance. Designed to stand up under severe operating conditions, it is fitted to the job by skilled engineers. It helps immeasurably to fulfill contracts speedily and profitably.

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BLAW-KNOX ROAD BUILDING EQUIPMENT includes: BATCHERPLANTS ROAD FINISH-SPREADERS (Manual or Automatic) TRUKMIXERS BULK CEMENT PLANTS Trukmixer Loading Plants ROAD FORMS DIRTMOVERS BULLDOZERS STEEL STREET FORMS TAMPING ROLLERS ROAD FINISHERS (Gas-Electric) CONCRETE BUCKETS CLAMSHELL BUCKETS CEMENTTANKS STEEL BUILDINGS STEEL GRATING Literature on any of the above BLAW-KNOX Products will be sent upon application

Use of Aluminum Boom Increases Speed, Profits

The swing speed of an excavator is an important aspect of economical operation. The swing cycle may be divided into three periods: (1) acceleration, (2) uniform speed, (3) deceleration; with periods (1) and (3) approximately equalling period (2) on a 180-degree swing. In addition, it is evident that the speed acceleration and deceleration varies directly with the power available and the swing inertia of the rotating parts. Thus, the swing inertia for a 175-foot composite aluminum-steel boom with a loaded bucket will be 8.6 per cent more than for a 150-foot all-steel boom, and with an empty bucket it will be 4.1 per cent less.

On the average machine there is adequate surplus power to compensate for the slight increase in inertia with the loaded bucket, and in actual operation the swing cycle for the two booms is the same.

Greater performance is a direct result of the 25-foot increase in boom length. Assuming that the excavator works with the boom at an angle of 20 degrees with the horizontal, the working diameter is increased 44.4 feet, and the dumping height is increased 6.6 feet, as a result of which more earth can be reached in the borrow pit from each station without the necessity for rehandling, and stockpiles can be made higher when rehandling is necessary.

Actual results show that the speed of construction has increased from 10 to 30 per cent with the use of the composite aluminum booms, an important consideration where time is a factor.

Govt. Approves Experimental Use of Cotton for Highways

The use of funds for the purpose of stimulating field tests of new uses of cotton in highway construction has been approved by Secretary of Agriculture Wallace.

The project provides for the diversion of manufactured cotton fabric for use as a reinforcement membrane in bituminous surface-treated highways and for cotton mats for curing concrete highways. These materials will be furnished upon request to state highway departments so that they may be tested in widespread areas and under all climatic conditions. The project involves the allocation of \$1,300,000. Under the program, cotton fabric for bituminous surfaced roads will be provided for a maximum of 1,000 miles of this type of road. Approximately 80,000 cotton mats for curing concrete roads will be made available for an average of at least three projects in each state.

The administration of the project will be carried out jointly by the U. S. Bureau of Public Roads and the Agricultural Adjustment Administration.

WON'T QUIT or cause time out



A Hayward Bucket keeps the job going ahead on scheduled time. It won't quit or cause time out.

The Hayward Company
32-36 Day Street
New York, N.Y.

Hayward Buckets



The New Lufkin Tape-Rule

All-Purpose Tape Rule

A new all-purpose 6-foot steel tape rule, known as the Mezurall, has recently been announced by the Lufkin Rule Co., Saginaw, Mich., manufacturer of measuring tapes, rules and precision tools.

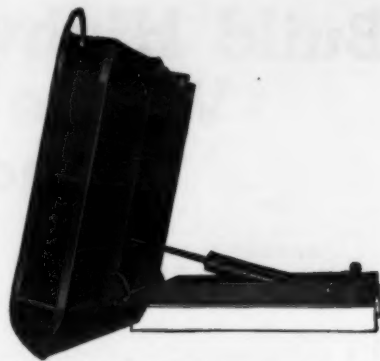
With this rule, common measuring, either butt end or hook, is done in the usual way. To take an inside measurement, it is necessary only to butt the square back edge of the case against one side of the opening being measured, extend the blade to the other limit, and add 2 inches to the reading clearly indicated, the case being just 2 inches wide. The end hook of this tape-rule has a short sliding action, automatically adjusting itself to give accurate results

when hooked over any object.

The Mezurall is small and light weight and can easily be carried in the pocket. The steel blade will stand unsupported, like a rule, yet is also flexible, like a tape.

New Heavy-Duty Body Hoist Gives High Dumping Angle

A hydraulic hoist which is double-acting, designed for 1½ to 2-ton trucks, with a 77-degree dumping angle, has been placed on the market by the St. Paul Hydraulic Hoist Co., Minneapolis, Minn. The St. Paul Hi-Dumper, with its 77-degree dumping angle, provides instantaneous dumping of all sticky materials. When the load is dumped, the body is returned to normal position by the hoist which pulls it back by hydraulic action. The hoist can be used to pull the body all of the way back, or can be released after the body reaches a 60-degree dumping angle, from which it will return to the sub sills by gravity.



The St. Paul Hi-Dumper Showing the 77-Degree Dumping Angle

The control valve in locked position makes it possible instantly to hold the body at any angle. This is useful when spreading a load over a road bed. An exclusive feature is the St. Paul safety check which regulates the body and load, preventing its traveling to its full dumping height except at normal dumping speed.

Cedar Point Road, Lucas County, Ohio. Tarvia-built in 1913 when automobiles were as rare as horse-drawn vehicles are today.



Twenty-three years of uninterrupted service is not an exceptional Tarvia performance record. Highway officials all over the country have had similar experiences with low-cost Tarvia pavement. They know that only the simplest and most inexpensive maintenance is needed to make a Tarvia road last indefinitely—always smooth, easy-riding and skid-safe. The Tarvia field man will give you details. Phone, wire or write our nearest office.

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Build Highways Where Needed and As Needed

By EARL B. LOCKRIDGE
Field Engineer of Maintenance, State
Highway Commission of Indiana

GOOD, first class Maintenance borders so close on Stage Construction that it is frequently difficult to distinguish between where Maintenance leaves off and Construction begins. In fact stage construction is of such character that it lends itself in the earlier steps to being carried on by maintenance organizations and equipment.

What Is Stage Construction?

Most highway engineers think only in terms of road surfaces as they are developed progressively from the loose or traffic-bound gravel and stone to the more costly high-type pavements when stage construction is mentioned. Since it is obvious that there are necessarily many things to be arranged for and accomplished previous to the actual assembling of physical materials into the road surface, for the purpose of this discussion I am going to define Stage Construction of roads as their progressive improvement by successive betterment operations. There are certain essential steps in any highway construction which occur in about the following order: Preliminary Surveys, including traffic census; Detailed plans and specifications; Arrangements for financing project; Securing of adequate right-of-way; Awarding of contract; Arrangements for proper inspection including sampling of materials; Provision for handling traffic during construction; Lastly, no construction should be contemplated without considering how it will adapt itself to future maintenance.

Survey and Traffic Census

Preliminary surveys and traffic census

By Stage Construction, Counties and States May Improve Roads as Funds Accumulate

are of utmost importance. A few more dollars and perhaps several weeks time spent in determining the proper location of a highway may mean everything in its future development and the returns it will pay on capital invested in way of service as a public utility. Preliminary surveys are quite simple in a level or slightly rolling country as compared with those required where hilly or mountainous in character. One might conclude that in general the shortest route is the most desirable. However before arriving at such assumption, some consideration must be given to practicability of such location. The character of grade and alignment obtainable should be looked into thoroughly. Likewise cost must be taken into account both as to construction and future maintenance. For example, we have learned from experience that to build along the hillsides of southern Indiana accompanied with slides and to cross the muck lands of northern Indiana with subsequent settlements mean costly maintenance.

At this stage of the procedure the traffic census should be consulted and both present and future traffic requirements appraised. An intelligent traffic count will reveal much, but if not intelligently interpreted may be very misleading. It is not always possible to foresee or anticipate the increase of travel that will come about when new routes are provided or old ones improved. Not only must thought be given to the communities to be served by the improve-

ment and near either terminus, but a broader observation must be made to determine just how the improvement under consideration will fit in with a general scheme of highway transportation. Will the project and subsequent adjacent developments materially influence the trend and channels of travel? Having carefully considered these matters, we are now ready to complete the field surveys, definitely locate the right-of-way and prepare detailed plans and specifications.

Plans and Specifications

Detailed plans and specifications have much that is routine and applicable to construction in general. There is hardly a job, however, that does not have some special provisions and certainly none wherein the grade and alignment sheets could be substituted from another. In a rugged country the grade and alignment necessarily go hand in hand, since each will depend upon the other to a certain extent in order that required standards may be met within reasonable limitations. Stage construction of roads contemplates additional or successive improvements being made as traffic requirements demand and when the expenditure of additional funds is justified and the money is available. Certainly this development procedure cannot be carried out economically if it is not contemplated in the original laying out of alignment and grade and placing of structures. To provide properly for stage construction, too much care cannot be taken in providing proper grade and alignment, not only for such type of surface as is intended at this time, but for development by successive stages even to the highest type of pavement known to modern engineering.

Financing

Arrangements for financing the project must not and cannot be overlooked.

Many cases are on record where apparently every engineering detail had been worked out in the way of preparing a

(Continued on next page)

The BURCH
BALANCED
POWER
HOIST



ONLY ONE MOVING PART

Balanced power for raising or lowering—automatic locking, any position—one moving part—no gears—no oil lines—no heating or foaming of oil. Plain and Braced Side Bodies—1½ and 2 Yard capacities.

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The cost records of contractors show that V-8 Economy is OVER-ALL ECONOMY. The savings made in fuel and oil are only a part of the story. Similar savings are possible in all other variable costs... as well as in depreciation, wages, license, taxes and other fixed costs. Your Ford dealer invites you to make your own tests, with your own loads, under your own operating conditions. Call him today and set a date for an "on-the-job" test.

\$25 PER MONTH, with usual down-payment, buys any 112-inch wheelbase Ford V-8 Commercial Car.

FORD V-8 TRUCKS

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NEW TWO WHEELERS
WITH
PNEUMATIC
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TIMKEN
BEARINGS



**SEND FOR
FREE
BULLETIN
ON THESE
LATEST
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" 7S and 10S machines or other MASTER and SILVER-STREAK Non-tilts from 3½ to 28S, WONDER Tilters from half-bag to two-bag capacity, also CMC Hoists, Plaster and Mortar mixers, Pumps, Saw Rigs, BETTER BILT Wheelbarrows, Concrete and Material Carts with steel wheels or pneumatic tires. " " " "

CONSTRUCTION MACHINERY CO., WATERLOO, IOWA

Build Roads Where And As Needed

(Continued from preceding page)

complete set of plans and specifications for a perfect piece of construction and then they were never put in operation because of inability to finance the project. Here is where stage construction is useful. As an illustration I recall a certain religious organization that wanted to build a church but being limited in money could only make excavation for the basement, put in the foundations and walls up to first floor level over which they erected a temporary flat roof. They erected a sign in front of this first stage of construction which was taken from the Bible and read as follows:—"He that seeketh findeth"! That was stage construction pure and simple, but to be practical it was necessary that the foundations be installed with the finished building in mind. Not being able to finance the entire structure, work proceeded on the installment plan. This same principle can be applied to road construction most conveniently. Where limited finances are available the first stage of construction may contemplate only grading and structures.

Secure Adequate Right-of-Way

Securing of adequate right-of-way is most important. Right-of-way width should not only be sufficient on which to complete the type of improvement planned, but some allowance should be made for additional future requirements. The arguments for wide rights-of-way are so many and so convincing that it seems hardly necessary to present them in this paper. However, it is of a decided advantage to secure in the first place all of the right-of-way that may ever be needed. Not only can it be had at a more reasonable price, but any roadside planting that may be done will be where it can be preserved, the utilities will not have to be disturbed later and adjacent private improvements can be made with the assurance that they are not to be molested.

Contracts—Inspection—Traffic

The awarding of contracts on public works is largely controlled by statute, however, there is much the official can do in way of preparing an intelligent and comprehensive proposal blank. Experience record and equipment and financial statements of bidder should be available and all proposals thoroughly canvassed before an award is made.

Proper inspection should be had at all stages of the work which naturally must include the sampling and testing of materials. This function is most likely to be neglected or given insufficient attention in stage construction.

Provisions for handling traffic during any construction must be considered. In the case of stage construction, restricted traffic is frequently tolerated throughout the improvement period.

Think of Future Maintenance

No construction should be contemplated without considering how it will adapt itself to future maintenance. Many "white elephants" have been created because of failure to consider the proposed improvement from this angle. At least an attempt should be made to visualize its future behavior and existing or available means of maintenance. This leads us back again to the matter of plans and specifications.

Of recent years there has been a growing conviction among authorities on highway development that primary and secondary, or state and county roads if you please, are integral parts of one road system to be jointly financed and improved, each in proportion to its traffic and social service possibilities. What is the distinguishing difference between a

primary and a secondary road? At best the division is a more or less arbitrary one based upon the amount and kind of traffic and modified by the practical consideration of building and maintaining certain through routes to a somewhat higher standard for the kind of traffic than might be warranted by the volume.

It has been said that any community whose citizens can afford to own motor vehicles can afford all-weather roads. Assuming that the first stage of construction, that of providing proper grade and alignment on adequate right-of-way, has been completed, how are we going to arrive at a decision on what will be the most practical wearing course to provide as our next stage? Certainly a traffic census should be considered again and some thought given to the amount and kind of traffic to be handled. Perhaps the traffic has not sufficiently developed as yet, due to prevailing conditions, to determine just what might be expected in the future. This being the case, some inexpensive type of surface will be considered, having in mind its future value as it may become necessary to add successive courses from time to time to meet requirements of increased quantity and weight of traffic.

Subgrade Controls Surface Condition

Recently much study has been given to soils to learn their comparative values as subgrade material or as stabilized surface material. Subgrade character exercises a controlling influence on road condition. Surface design that is adequate for a given traffic on one type of soil may be wholly inadequate for an inferior type. Drainage must be reckoned with and cannot be ignored. One of the advantages of stage construction is to produce uniformity of subgrade settlement and stability before investing in the more costly type of surfaces. A relatively thin pavement or wearing course sufficient to meet a given traffic load can be built and maintained on a subgrade of high support value cheaper than a thick pavement or wearing course can be built and maintained on a hit-and-miss subgrade. It is self-evident that the subgrade finally carries the highway load, regardless of what kind of pavement is placed upon it. Therefore, utilizing subgrade values is essential in design practice. In fact pavements are merely amplified subgrades.

Availability of suitable local materials should be given consideration in surface design. However, public officials should not be forced to use inferior local materials where it means sacrificing quality of work.

Successive Surfaces

The second stage may be one of the soil stabilized surfaces or perhaps local

plant-run gravel or stone to a compacted depth of about 2 inches. Successive stages may follow within a few months or possibly not for several years, depending upon traffic requirements and available funds. If the surface is of such a character as to require considerable replacement because of wear, and materials are not conveniently available at reasonable cost, it may prove economical to advance to the next stage quite soon to avoid not only an unsatisfactory surface condition, but to get away from high maintenance costs.

The third stage may consist of spreading additional metal and binding it with some agency such as calcium chloride or road oil. Succeeding stages may consist of dual bituminous surface treatments, mixed-in-place retreads, or any of the higher type of pavements. Old rigid-type pavements that have become broken and rough riding, resulting in increased impact that rapidly destroys them, make excellent bases if patched in time and can be given a bituminous mixed or rock asphalt wearing course at a nominal cost that will prolong their life more or less indefinitely.

Each road project is a special problem requiring a complete knowledge of the strength of the existing pavement and subgrade and careful alternate estimates of different methods of treatment. There are a number of solutions which will serve the purpose provided the general basic principles are not violated. For instance, a high type surface should never be used on a weak base. In fact any low cost road without sufficient base course will prove to be expensive.

From a paper presented at the Twenty-second Annual Purdue Road School, Lafayette, Ind.

Rotary Air Compressors

Two-stage rotary air compressors producing pressures up to 100 pounds have been produced by the Allis-Chalmers Mfg. Co., Milwaukee, Wis. in its "Ro-Twin" compressor. Formerly, two-stage rotary compressors of the sliding vane type were formed by coupling together two cylinders and operating them in series, with an external intercooler between the stages.

In the Ro-Twin compressor, both stages as well as the intercooler are contained in a single casing, making an extremely compact unit. The air passes directly from the first stage to the intercooler and thence to the second stage without leaving the cylinder. Only one

stuffing box is necessary and that on the low pressure side, and only one coupling, making alignment with the driving machine very simple. The intercooler is very compact, due to the use of finned tubing, and is easily accessible.

As in all A-C rotary compressors, there are two floating rings, one in each stage, which prevent the blades from bearing on the casing. A ball thrust bearing maintains the rotor in alignment.

These compressors are provided with an automatic unloader comprising an air-operated, spring-loaded suction valve controlled by a pressure governor. The governor is so arranged that when a predetermined maximum pressure is reached, compressed air is admitted to a piston, closing the suction valve. Simultaneously, the check valve in the discharge line closes and a by-pass opens from the discharge to the suction, completely unloading the compressor, the speed remaining constant. These compressors are built for electric motor drive.

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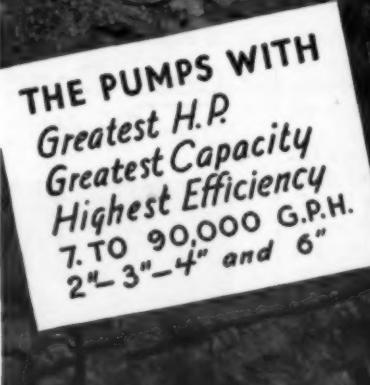


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Why Contract Bonds Are Sometimes Hard to Obtain

By MALCOLM MAC DONALD

IT should be realized that the surety companies are anxious to accept applications for contract bonds if the risk is what they consider to be a normal one. They are, it is obvious, in business for just that purpose.

Even in normal times, however, they demand proof that a risk is not abnormal. They ask for all information that has any bearing upon the ability of the contractor who seeks to obtain a bond: his financial strength and many other items, some of which may seem to the applicant to be irrelevant.

Financial stability is a prime factor in the eyes of the underwriters—that is, financial power in proportion to the amount called for by the contract under consideration—and it overshadows all other particulars.

Insufficient monetary resources, it has been found by experience, cause more claims against contract bond sureties than any other single weakness. Consequently, if the contractor does not measure up to a more or less set standard, financially, his application for a bond is likely to be turned down.

Speaking by and large, the companies hold that a contractor should have at least 10 per cent of the cost of a projected operation in liquid assets, and additional assets amounting to from 10 to 15 per cent of the total.

How Financial Status Is Determined

In estimating a contractor's financial condition, the surety companies call for an itemized statement of assets and liabilities. A statement attested before a notary is requested because most people hesitate to swear to a false declaration, although they may have little or no reluctance about submitting a garbled balance sheet if they do not have to take oath as to its accuracy.

Reported bank balances are also verified. If a banker is given as a reference, the surety company likes to make certain that the said financier is disinterested and not a creditor who would welcome the opportunity to induce a well-heeled insurance company to become involved in the misfortunes of a tottering contractor.

The contract to be undertaken by an applicant for a bond is carefully examined because certain jobs are much more hazardous and likely to run into trouble than are others.

Subway operations, for example, river tunnels and similar underground work are bonded generally only for large and successful organizations. Lighthouses, breakwaters and reservoir and power dams are also among the risks considered overly dangerous.

It is important, too, from the surety's standpoint, to learn whether a contractor has had ample experience in completing work similar to that for which a bond is desired. Some contractors bid too freely, and when work is scarce in a familiar field, they may bid "out of their sphere." A contractor becomes identified with jobs in a certain line and in a given price range, and when he steps out of it, the surety company becomes somewhat skeptical as to his ability to make good.

There is a man in New Jersey who has specialized for a number of years in building school houses; recently he began bidding on large apartment house projects and was surprised when the company to which he applied for a bond on a contract covering a multiple-family structure declined to bond him.

In recent years, curtailed building activity caused many contractors and builders familiar with structural jobs to enter into road construction, a field where

Many Factors Must Be Considered by Surety Cos. Their Caution a Boon to Responsible Contractors

profits have been in sight owing to Federal and other appropriations. Many contractors failed to complete such work and the frequent claims on the surety corporations that grew out of such operations have made underwriters wary.

Importance of Checking Bids

Another consideration of the insurer is the comparison of the amount of the successful bid with those nearest to it. If competing tenders are fairly close to that of the winner it is looked upon as a good sign. If, on the other hand, the chosen bidder's price is far below the others, the surety deduces that some important cost has been overlooked or that some vital element has been disregarded.

The records contain the case of a contractor who, in bidding on a large public works project, submitted a figure \$100,000 lower than that of his nearest competitor. The error was discovered by the engineers representing the public officials, but the contractor had to forfeit \$10,000 since the proposal regulations carried this stated penalty. The contractor's loss, however, might have been \$100,000.

Surety underwriters do not like to see maintenance guarantees in contracts—such guarantees as that a roof "shall be rain-tight for at least ten years"—because they sometimes make undesirable an otherwise acceptable risk.

It is felt that such guarantees are unfair to contractors because the latter have to follow prescribed specifications and are not free to use their own judgments beyond a certain point.

The guarantee feature is particularly disliked in connection with road building jobs because the march of time changes conditions. An avenue of once light traffic may become, as the result of some unexpected development, a heavily-traveled thoroughfare that will wear out more rapidly than anticipated.

A heavy penalty for delay in completing a contract is another factor which

may cause a surety company to decline a proffered risk.

When There Are Subcontractors

If the main contractor on a large project sub-lets parts of the work, the subcontractors should be bonded in favor of the principal. The bonding corporations do not like to see many subcontractors entering into the picture for the reason that often such secondary workers do not fulfill their obligations and the result is that responsibility falls back upon the main contractor to complete an operation. Here again the matter of financial strength comes into the situation.

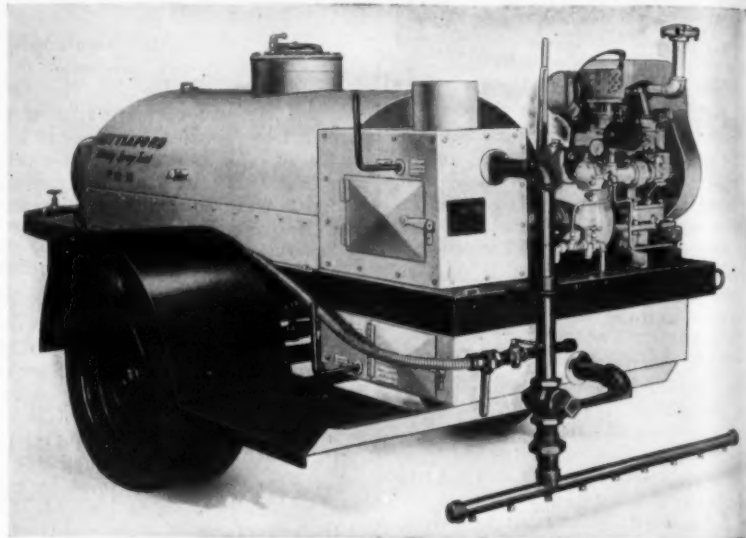
Although contractors often feel that bonding companies are too strict and narrow in deciding on bonding applica-

tions, it is held by many surety men that careful underwriting tends to improve the general status of the contracting business by rendering protection to principals who deserve it, and by eliminating irresponsible, "shoe-string" contractors.

A Record of Diesels

Cummins Engine Co., Columbus, Ind., manufacturer of Cummins diesel engines, has prepared a profusely illustrated booklet on installations of Cummins diesel engines in trucks, busses, industrial applications such as construction equipment and in the marine field.

Copies of this booklet may be secured direct from the manufacturer.



SEEING IS BELIEVING

The officials of a southern city saw this Littleford No. 101 Utility Spray Tank at the Road Show in January. In less than two weeks' time after returning home, they placed their order for the unit.

You, too, will realize the benefits this

modern maintenance unit can give when you consider savings in bulk prices on bitumen and time of handling. Motor driven, double heating system, 300 to 1200 gallons capacity, this outfit is complete. Write for prices, now.



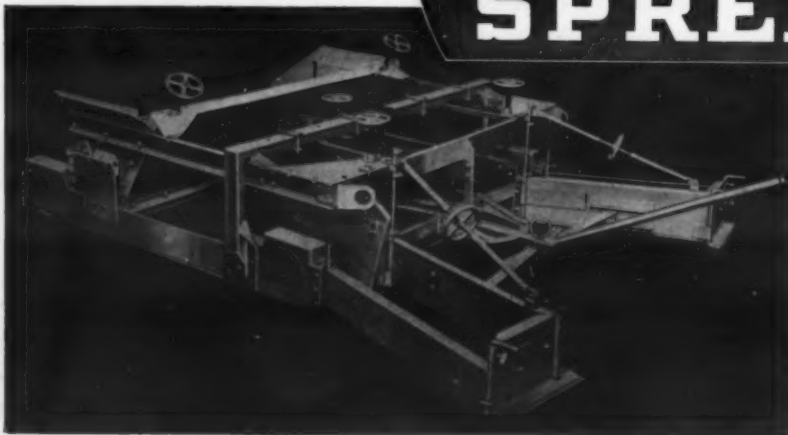
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Knickerbocker 7-S with 60-Degree Loader Pitch

Fast Loading, Discharge in Knickerbocker Mixers

Contractors want to mix good concrete at a speed that will result in a profit on each cubic yard placed. Engineers require that each batch turned out shall have a given quality, no matter what the time of mixing. Working with construction engineers and with contractors, the Knickerbocker Co., Jackson, Mich., has sought to design a mixer that would satisfy the demands of both contractors and engineers for quality concrete and the particular demands of the contractor for speed.

The result is the 1936 Knickerbocker, in which is embodied a larger diameter of drum providing better mixing action and making possible drum openings larger than usual. This speeds loading as the charge enters the drum quickly, without choking. Fast charging is also facilitated by a wide-throated loading skip that raises to a 60-degree pitch. The larger discharge opening permits quick discharge and the manufacturer calls attention to the wide discharge chute, which when in mixing position, extends into the drum and deflects the water as it enters the drum to the charging side, where it should go. It deflects the mix as it pours from the mixing buckets and throws it back across the drum onto the blades, resulting in a remixing action.

The low center of gravity of the Knickerbocker mixers gives them stability, and makes them safe to transport. They are made in five sizes, 5, 7, 10, 14 and 28-foot capacities, are equipped with calibrated, non-pressure, siphon-type water measuring tanks and are available with a variety of wheel and tire equipments.

New Forth Bridge in Scotland

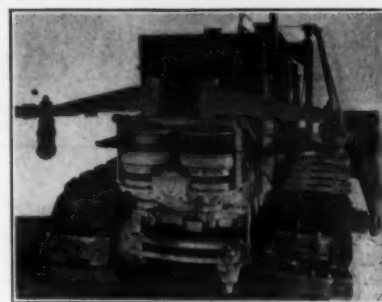
Work on the new Kincardine-on-Forth Bridge in Scotland is progressing satisfactorily, according to a statement by Sir Alexander Gibb and Partners, consulting engineers for the bridge, in the *Municipal Journal & Public Works Engineer* of London.

The Kincardine by-pass road and the south approach road are completed and the foundation for piers 3 to 9 were satisfactorily obtained on solid rock in every case. The concreting of all piers was carried out at the rate of one a month. Attempts made by the contractor towards dewatering of the cofferdam of

the main pier had so far been unsuccessful. Consideration was given to alternative means of insuring a sound foundation for this important pier, and ultimately it was decided to put down six circular piers 14 feet 6 inches in diameter around the outer circumference of the main pier on which the upper portion of the pier would be carried by means of a reinforced concrete slab, tying together the heads of the cylinders. The pier will carry what is believed to be the largest swing span bridge section in Europe. It is designed to open and provide two 150-foot channels.

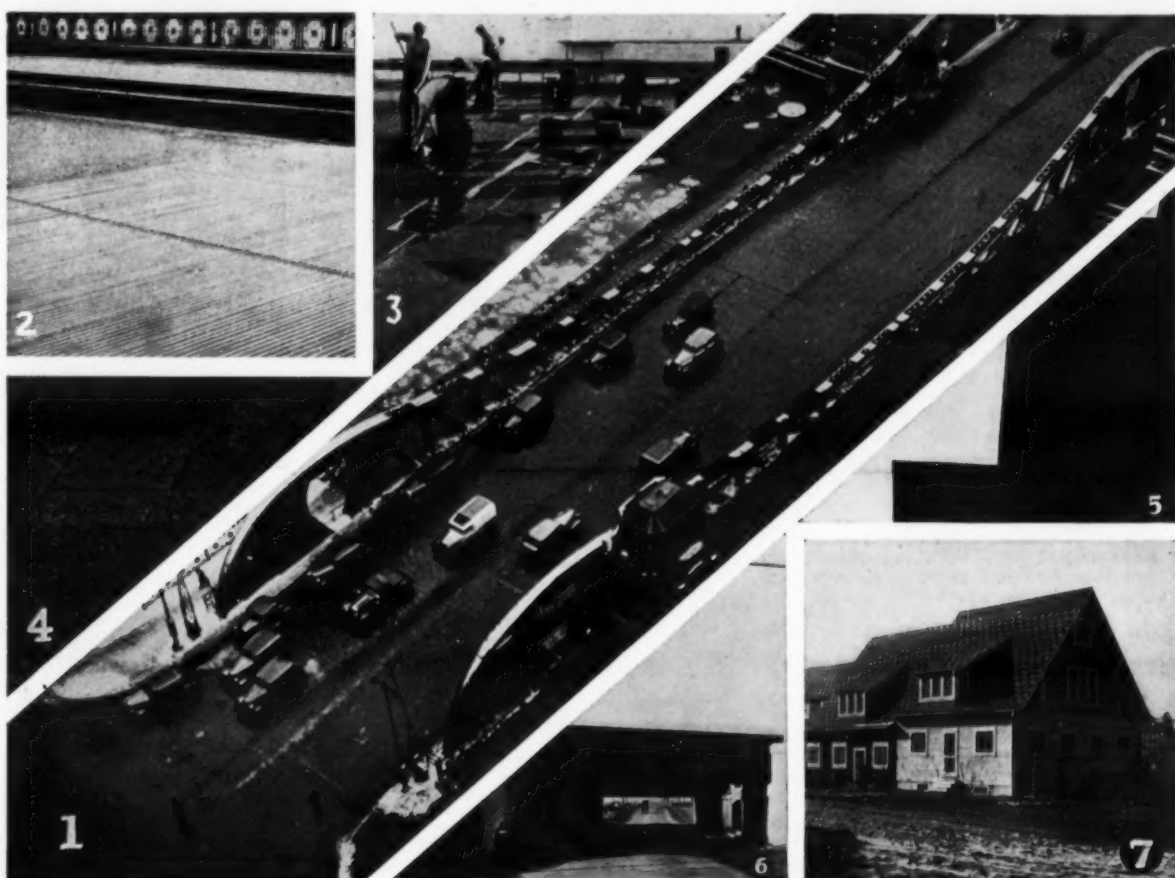
A Power Control Winch For Heavy-Duty Tractors

The illustration above shows the rear view of an 80 Cletrac diesel-powered tractor equipped with a power control Hutchins winch made by the Hutchins Winch Co., Los Angeles, Calif., with a cable-operated bulldozer mounted on the tractor.



The Hutchins Power Control Winch

This power-controlled unit is available for operating scrapers and trail-builders. The cable is wound around a large capacity drum and in operating a scraper would unwind directly from the drum to the scraper. This eliminates leading the cable through a series of sheaves which produce flexing of the cable and premature wear. The drum is located so low that the pull comes low on the tractor, thus having less tendency to lift the tractor in front.



Servicised ASPHALT PLANKING

More than seven years ago Servicised standard bridge planking was laid on Chicago's LaSalle Street bridge, Figure 1. Today the same material with no replacements or repairs gives promise of providing a perfect wearing surface indefinitely. Figure 2 shows Servicised Sementread non-skid planking for bridges. Specifying asphalt plank for roof decks has become common usage with many architects since the World's Fair, Figure 3, proved its practicability. Figure 4 shows Servicised Rock-Surfaced non-skid planking for bridges. Time proven standard asphalt plank is used wherever a tough but resilient wearing surface is required—see Figure 5. Recently completed 95th Street underpass, Chicago, Figure 6, has Servicised asphalt plank protecting its membrane waterproofing from puncture by railroad ballast. Figure 7 shows standard and Sementread planking for building and power plant construction.

In addition to the above-illustrated, more common uses of Servicised asphalt plank, it is regularly specified for industrial floors and loading platforms, as a protection for corkboard walls of refrigerator rooms, and as filler for steel channel bridge floors. Where wearing quality and lightness in weight is desired use asphalt plank. Servicised will give you service on your requirements of asphalt planking of any type, for any use, anywhere, anytime.

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657 Ford Motor Co., Dearborn, Mich., will be glad to send complete information on the Ford V-8 truck which it is claimed will help you reduce your hauling costs, as well as send you the name of your nearest dealer where you can arrange for an on-the-job test with your own loads, over your own roads, with your own driver.

658 The 1936 Ace Joint Catalog, containing complete information on the Ace metal joint as well as recent data on structural highways, may be secured by interested readers direct from the American Concrete Expansion Joint Co., 221 N. La Salle St., Chicago, Ill.

659 The Briland sand spreader built low to make it suitable for use with practically all makes of dump trucks and with connecting arms with adjustments which make it possible to meet practically all conditions likely to be encountered is described in a 4-page folder which may be secured from the Landenberger Road Equipment Corp., Fort Wayne, Ind.

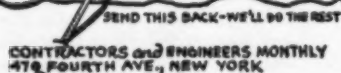
660 Under this title, Solvay Sales Corp., 40 Rector St., New York City, has issued a helpful 32-page illustrated booklet on the use of calcium chloride for integral and surface curing of concrete roads, for maintenance, other uses of calcium chloride and standard specifications. Copies of this booklet will be furnished free on request.

661 The reproduction of county and state maps by the Lithoprint Process on tracing cloth with any portions blocked out to permit retracing of revised lines and the inclusion of additional data is described in literature which may be secured from the Lithoprint Co. of New York, Inc., 41-43 Warren St., New York, N. Y.

662 A handy pocket slide rule which quickly and easily gives valuable information about the per-yard cost of dirt moving as well as the operating efficiency of Carryall scraper units has been developed by R. G. LeTourneau, Inc., Peoria, Ill., who will be glad to send one of these slides to readers of this magazine who write for one.

663 Complete information on the Buckeye surface material spreader which is attached to a truck, works forward or reverse, is equally efficient for new construction, resurfacing or patching and lays down quantities up to 60 pounds per square yard, may be secured by interested contractors and highway engineers from the Buckeye Traction Ditcher Co., Findlay, Ohio.

664 Walter motor trucks, features of which are their 4-point positive drive, 100 per cent traction, power and speed, which are made in 5 to 6-ton models for heavy-duty service, are described in literature which interested contractors and highway department engineers may secure direct from the Walter Motor Truck Co., Inc., Queens Blvd. at 37th St., Long Island City, N. Y.



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665 The Hanson Model 52 $\frac{1}{2}$ -yard shovel or 8-ton crane, of unit cast steel construction, ball and Timken bearing equipped, with either gasoline or diesel power, is described and illustrated in literature which the Hanson Excavator Works, Tiffin, Ohio will send on request.

666 A 40-page catalog of sizes, list prices, strengths and general information on Macwhyte wire lines for drilling of interest to all owners and operators of drilling equipment may be secured direct from the Macwhyte Co., Kenosha, Wis.

667 The Jaeger automatic finisher for concrete or bituminous pavements which will handle up to 1,000 tons of bituminous material daily is described in catalogs which the Jaeger Machine Co., 701 Dublin Ave., Columbus, Ohio will be glad to send.

668 Bulletin J-12, a new booklet containing descriptions and illustrations of Clyde Whirleys, as well as a history of this piece of equipment and general information as to its use, may be secured by those interested direct from Clyde Iron Works, Duluth, Minn.

669 The Skilsaw portable electric hand saw for use on the many odd jobs to be done on any construction project is described and illustrated in literature which may be secured from Skilsaw, Inc., 3310-20 Elston Ave., Chicago, Ill.

670 The Baker Mfg. Co., 585 Stanford Ave., Springfield, Ill., has recently issued two new bulletins: No. 553 describing Baker grade builders and No. 554 describing Baker direct-lift twin-cylinder bulldozers, both adapted for Allis-Chalmers tractors.

671 Complete information on the 1936 Chevrolet trucks, features of which are the new hydraulic brakes, new high-compression valve-in-head engine, and full-floating rear axle, may be secured by those interested from the Chevrolet Motor Co., Detroit, Mich.

672 Complete information on the use of Texaco asphaltic products in the construction of economical, rugged, low-cost roads may be secured by interested contractors and engineers from the Texas Co., Asphalt Sales Dept., 135 East 42nd St., New York City.

673 Le Roi Co., Milwaukee, Wis., will send on request its complete catalog describing Le Roi-Rix single or two-stage, portable or stationary air compressors which have a number of special features and are made in a variety of mountings.

674 Complete information on the Flex-Plane road joint installing machine for building smooth lasting concrete pavements may be secured by interested contractors and engineers from the Flexible Road Joint Machine Co., Warren, Ohio.

675 All-steel non-breakable pump strainers with inner tube and threaded for self-priming pumps, in 2, 4, 6 and 8-inch sizes, are described in literature which may be secured upon request from Rife Hydraulic Engine Mfg. Co., 75 West St., New York City.

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Lubrication Reference Manual

676 An industrial Lubrication Reference Manual, containing a store of vital information needed for the efficient lubrication maintenance of machinery, and illustrated with photographs and diagrams, may be secured by writing to Alemite Division, Stewart-Warner Corp., 1850 Diversey Parkway, Chicago, Ill., and mentioning this magazine.

All Steel Hand-Hoists

677 Beebe all-steel hand hoists in three sizes, a 2-ton Lightweight, a 5-ton General Utility, and a 15-ton triple-gear special, and which are compact, powerful and safe, are described in literature which Beebe Bros., 2724 Sixth Ave., So., Seattle, Wash., will send on request.

Deep-Well Turbine Pumps

678 Worthington Pump & Machinery Corp., Harrison, N. J., has issued a new informative broadside on its vertical turbine type pumps for deep-well, drainage and construction dewatering. This Bulletin W-450-B27 is available to any interested parties.

Combined Pulling Jack and Chain Hoist

679 The Anchor one-man outfit for pulling, moving, shifting and lifting heavy loads, known as the Puller-Hoist, which is a combined pulling jack and chain hoist, is described in Bulletin No. 116 which the Edelblute Mfg. Co., Reynoldsville, Pa., will be glad to send on request.

Dump Trucks for Construction Jobs

680 Literature describing Reo dump trucks for every type of construction job, features of which are low cost, dependability, and long-lived service, may be secured by interested contractors and state and county highway officials from the Reo Motor Car Co., Lansing, Mich.

Portable Electric Tools With More Power

681 Power King portable electric tools including drills, drill stands and saws, which provide greater freedom from wear and breakdown, more power, longer life and less weight are described in an 18-page booklet which may be secured from the Portable Power Tool Co., Warsaw, Ind.

Hydraulically-Controlled 12-Yard Scraper

682 Austin-Western Road Machinery Co., Dept. Y, Aurora, Ill., will be glad to send upon request complete information on the Austin-Western 12-yard scraper, features of which are the full hydraulic controls operated from the tractor and the separate motor for operating the scraper.

Hoists for Contractors

683 Universal Hoist & Mfg. Co., 606 E. 14th St., Cedar Falls, Iowa will send to interested contractors on request complete information on its contractors' hoists which are made in two sizes, reversible and non-reversible, single or double drum, and are sold with or without engine or motor.

Crane and Sling Chain

689 DC Quality crane chain, built for heavy duty of pure iron and welded, every link of which is tested and inspected before shipment, as well as DC sling chains made from the same kind of chain, is described in literature which the Carroll Chain Co., Columbus, Ohio will send on request.

Light-Weight Shovel Speeds Small Jobs

690 Complete information on the P & H Bantam Weight shovel, a speedy light-weight unit powered with a Ford V-8 motor and designed for use on small jobs scattered all over the map, may be secured direct from the Harnischfeger Corp., 4419 W. National Ave., Milwaukee, Wis.

Leipzig Fair an Indicator of World-Wide Recovery

The 1,975th session of the 700-year-old Leipzig Trade Fair just concluded attracted over 200,000 business men from all parts of the world, surpassing the record of the pre-depression year of 1928. More than a score of countries including the United States sent in all 8,163 exhibits of their newest products, which occupied 1,590,000 square feet of floor space, a gain of 13 per cent over last year. The number of exhibitors and buyers from all parts of the United States increased 40 per cent over 1935. The sales in all departments approached half a billion marks, of which one third were for countries outside of Germany, indicating a widespread business pick-up.

Salt Stabilization Costs

Contractors are beginning to feel that there is no mystery connected with salt stabilization of roads, with the result that prices are becoming lower. Arthur R. Smith, Engineer of Tests, State High-

way Commission of Indiana, in discussing the subject of salt stabilization at the Thirty-third Annual Convention of the American Road Builders' Association, said that on some of the more recent projects in Indiana the cost of salt stabilized surfaces has been approximately \$5,000 to \$7,000 per mile

for a road 20 feet wide and 6 inches thick. The proximity of the material source is a very deciding factor. In general, Indiana stabilized roads are placed almost as cheaply as the traffic-bound roads. The cost of the chemical is about the only difference between these two types of roads.

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The LaCrosse KU offers more payload per pound of weight than any other trailer of this type on the market today. Unusual strength is made possible by extending the main beams clear through the full length of the trailer shaping them to fit the front deck without cutting the main flange. This, combined with the new small diameter pneumatic tires gives you a heavy duty trailer that meets the regulations of all States at very little more cost than a solid tired trailer. Don't buy a trailer without investigating the LaCrosse.

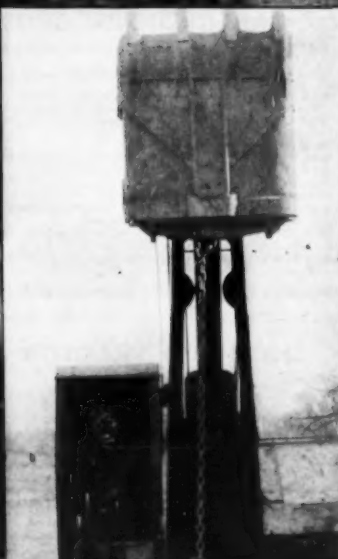
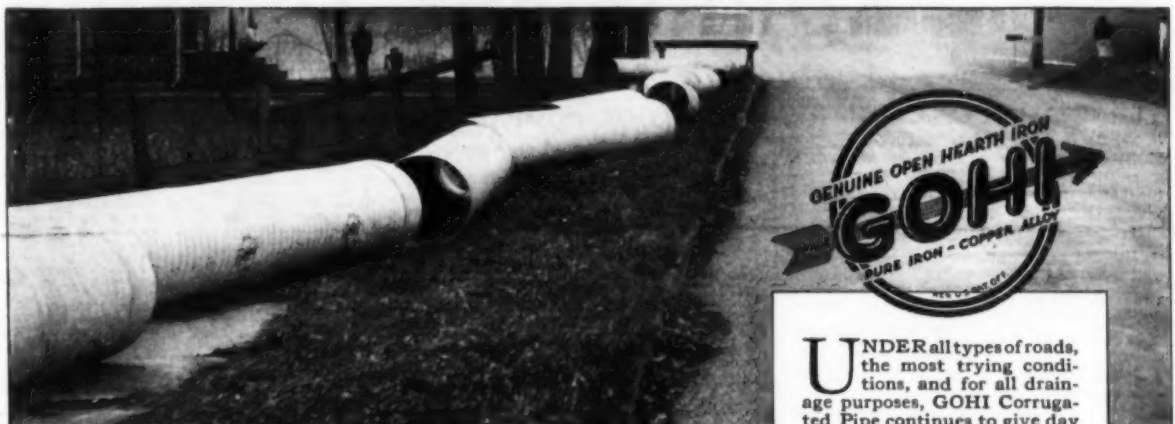
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GOES TO TOWN



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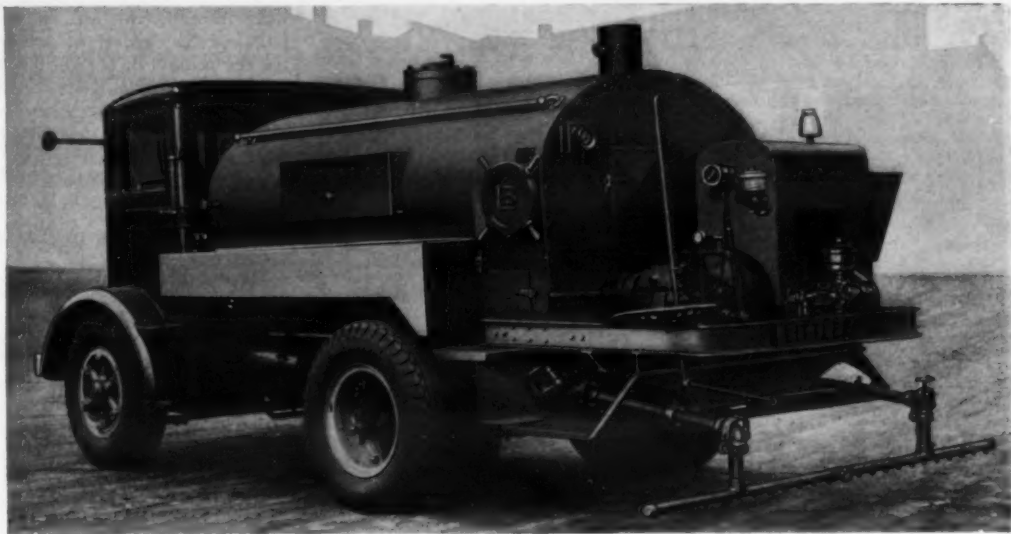
Picks and Shovels

(Continued from page 1)

ter of a mile separates the landing dock from the hotel which will shelter passengers for the night. This stretch is covered with very fine sand which seems nearly bottomless. An ordinary shell road can not be built successfully on this foundation and the situation presented something of a problem as to how to get passengers from plane to hotel as comfortably as they had been transported several thousand miles over the Pacific. The solution of the problem consists of a sand sled, in which passengers will ride, and a crawler tractor to draw the sled.

New 420-Foot Compressor Diesel Powered, Portable

The Gardner-Denver Co., 102 Williamson St., Quincy, Ill., has designed a new portable air compressor to deliver 420 cubic feet of air per minute and which it claims effects substantial fuel savings. This Model ABH 420-D two-stage, water-cooled unit is powered with a Caterpillar D-13,000 diesel engine, which uses 6 gallons of 6-cent fuel oil for one hour's operation at full capacity. The length of the portable compressor overall is 16 feet 7 inches.



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Multi Foot Pavers
Adams Black Top Pavers
Hetzl Steel Forms, Bins
Hetzl Finishing Mach.
Marsh Capon Mixers
Wander Concrete Mixers
Marlow Centrifugal Pumps
Marlow Diaphragm Pumps
Chrysler Portable Air Com-
pressors
New Haven Burlapped-Cot-
ton Blankets

Hayward Clamshell Buckets
Huber Rollers
Archer Towers, Buckets
LaCrosse Tu-way Trailers
Burch Stone Spreaders
Saugen Derrick, etc.
Fley Hoists
R-B Power Subgrader
Miles Block Machines
Pulsometer Steam Pumps
Say City Truck Cranes
Tay-Lay Steel Cable
Hoydels Constr. Furnaces
Jackson Wheelbarrows, etc.

GILES & RANSOME

17th St. & Sedgley Ave., Philadelphia

RANSOME CONCRETE MACHINERY CO.—
Concrete Mixers and Appliances
BLAW-KNOX CO.—Clam-shell Buckets, Steel
Forms, Steel Buildings, Steel Bins
CATERPILLAR TRACTOR CO.—Tractors and
Road Machinery
RICHMOND SCREW ANCHOR CO.—Concrete
Specialties
THE BARNES MFG. CO.—Centrifugal Dia-
phragm and Force Pumps
NORTHWEST ENGINEERING CO.—Gasoline
Cranes and Shovels
ORD—Road Finishing Machine
CLYDE—Hoisting Engines and Derricks
Member: Associated Equipment Distributors

HOWARD W. READ CORP.

800 N. Delaware Ave., Philadelphia, Pa.

Distributors

DOMESTIC ENGINE & PUMP CO.—Pumps
JONES SUPERIOR—Saw Rigs
LINK-BELT—Cranes and Shovels
PENNA. BOILER WORKS—Boilers
AUSTIN-WESTERN ROAD MACHINERY CO.—
Rollers, Graders, etc.

Additional Equipment in Stock:

INGERSOLL-RAND—Compressors
UNIVERSAL—Truck Cranes
Pile Driving Hammers

SERVICE SUPPLY CORPORATION

20th and Venango Sts., Philadelphia, Pa.

Representing

Bay City Shovels, Inc.—Shovels, Cranes, Cranesmobiles
Beaumont-Bird—Bins, all sizes
Chain Belt Co.—Belt Pavers, Mixers, Truck Mixers,
Pumps
Chicago Pneumatic Tool Co.—Air Compressors, Tools
Cleveland-Brooks—Tank Car Heaters, Boosters
Draw Equipment Co.—American Tubular Towers
Hercules Co.—Road Rollers
Hough-Universal-Sweepers
International Harvester—Industrial Tractors, Crawlers
Littlefield Bros.—Asphalt & Tool Heaters, Distributors
McKernan-Terry—Pile Hammers, Extractors
Neilsen Iron Works—Loaders
Lumber-Nat'l—Hoists, Car Pullers, Cableways
Owen Bucket Co.—Clamshell Buckets
Riddell Co.—Graders, Scrapers and Trucks
Member: Associated Equipment Distributors

J. JACOB SHANNON & COMPANY

1744—Market Street—1744

PHILADELPHIA

Representing

T. L. Smith Co.—Concr. Truck Mixers, Pavers, Glass
Mixers
Allis-Chalmers Mfg. Co.—Tractors, Graders
Ralph B. Carter Co.—"Humdinger" Pumps
Baker Mfg. Co.—Buildings, Blade & V Snow Plows
John A. Roebing's Sons Co.—Wire Rope, Fittings
E. I. du Pont de Nemours & Co.—Paints, Varnishes
Corset Surfacing Machy. Co.—"Borg" Concr. Surfactors
Red Star Products Co.—Adjustable Shores, Column Clamps
Saugen Derrick Co.—Derricks and Winches
Scheram, Inc.—Air Compressors, Pneumatic Tools
Wendy Hoisting Engine Co.—Gas, Elec., Steam Hoists
Shanno—Derricks and Derrick Fittings

ALLEGHENY EQUIPMENT CORP.

1218 Grant Bldg. Pittsburgh, Pa.

Distributors for

ALLIS-CHALMERS Tractors and Allied Trac-
tor Equipment
GARDNER-DENVER Compressors and Drills
HERCULES Road Rollers
HOUGH-UNIVERSAL Road Sweepers
JACKSON Concrete Placement Vibrators
LINK-BELT Power Shovels and Cranes
MICHIGAN ½-yd. Truck and Crawler Shovels
and Cranes

WESTERN MATERIAL CO.

Aberdeen, Sioux Falls, Rapid City, S. D.

Atlas Dirt Moving Equip.
Barber-Greene Conveyors,
Loaders, Ditchers
Bros. Snow Plows, Rd.
Bldgs.
Bucyrus-Erie Loadmaster
"Caterpillar" Equipment
Chain Belt Mixers, Pumps
Cleveland-Brooks Tank Car
Heaters
Clyde Hoists, Derricks
Day Crushers
Hough Sweepers
LaPlant-Choate Equipment
Leahart Wagons
LeTourneau Road Equip.

Line Tractor-Trucks
Littlefield Bros. Equip.
M & M Wire Clamps
Pioneer Gravel Equip.
Phillips Carey Elastic
St. Paul Bodies, Hoists
Scheram Air Compressors
Sterling Wheelbarrows,
Carts
Stelle Stone Spreaders
Toro Mowers
Walter Motor Trucks
Waukegan Snow Plows
Williamette-Hyster Hoists
Wood Shovels

Member: Associated Equipment Distributors

NIXON-HASSELL COMPANY INC.

Contractors' Equipment

Chattanooga Tennessee

Representing

BLAW-KNOX Buckets,
Forms
INGERSOLL-RAND Com-
pressors
MUNDY Hoists
AUSTIN-WESTERN Grad-
ers, Crushers, Rollers, etc.
BARBER-GREENE Load-
ers, Concrs.
NORTHWEST Cranes,
Shovels
HOMESTEAD Hyppressure
Jenny
Also Wheelbarrows, Carts, Benders, Cutters, Shovels, etc.
Member: Associated Equipment Distributors

EASTON Dump Bodies,
Cars, Truck
TRACKSON Trucks, Cranes
ARCHER Towers, Spouting
Equipment
REX Mixers, Pavers, Pumps
CLETRAC Tractors
W/PORT Culvert Pipe
VULCAN Gasoline Locomo-
tives
DOBBIE Derricks
HUGH—"Universal" Road
Sweeper

BROOKS-PAYNE-OSBORNE EQUIPMENT CO.

Knoxville 408 Davenport Rd. Tennessee

Bucyrus-Erie Co.—Shovels, Cranes, Draglines
International Harvester Co.—Crawler, Tractors
J. D. Adams Co.—Road Machinery
Gardner-Denver Co.—Compressors, Drills
Crucible Steel Co.—Detachable Bits
Hetzl Steel Form & Iron Co.—Bins, Batches
Chas. Hyatt & Co., Inc.—Distributors
Central Hall & Steel Co.—Woodbridge Trailbuilders
Jaeger Machine Co. Mixers, Concrete
Lakewood Engineering Co. Handling Equipment
Line Manufacturing Corp.—Linn Tractors
Pioneer Gravel Co. Mfg. Co.—Crushing, Screening Plants
Hewitt Rubber Corp.—Hose and Belts
Georgia-Carolina Oil Co.—Tractor Lubricants
Independent Pneumatic Tool Co.—Pumps & Elec. Tools
Taylor-Wharton Iron & Steel Co.—Steel Castings

Member: Associated Equipment Distributors

WILSON-WEESNER-WILKINSON CO.

Nashville Tennessee

Representing

Kochring Co.
Insley Mfg. Co.
Allis-Chalmers Mfg. Co.
Blaw-Knox Co.
C. H. & E. Mfg. Co.
German-Rupp Co.
The Parsons Co.
T. L. Smith Co.
Ingersoll-Rand Co.

Littlefield Bros.
McKernan-Terry Corp.
Smith Engineering Works
American Hoist & Derrick
Co.
Russo Mfg. Co.
Ames-Hawley Wyoming Co.
Baker Mfg. Co.
Cleveland-Brooks Co.

NASHVILLE—KNOXVILLE

Warehousing Stocks of Service

Reinforcing Steel and Mesh

Member: Associated Equipment Distributors

BROWNING-FERRIS MACHY. CO.

205 Exposition Ave. Dallas, Texas

Texas at Rice Sts. Houston, Texas

Representing

Hetzl Steel Form & Iron Co.
Lakewood Engineering Company
Pioneer Gravel Equip. Mfg. Co.
Barber-Greene Company
Sterling Wheelbarrow Co.
Jaeger Machine Company
Ingersoll-Rand Co.
Foots Co.—Pavers
Littlefield Bros.
Thaw Shovel Company
Trackson Co.—Crawlers, Hoists
McCormick-Deering—Tractors
Lidgerwood Mfg. Co.
Gallon Iron Works & Mfg. Co.
Chas. Hyatt & Co., Inc.

Member: Associated Equipment Distributors

R. B. EVERETT & CO.

3112-18 Harrisburg Blvd. Houston, Texas

BLAW-KNOX Road Plant
Equipment, Bins, Cans
Shell Buckets
CLYDE Hoisting Machy.
"P. & H." Gasoline Cranes
UNIVERSAL Form Clamps
McKernan-TERRY Pile
Hammers, etc.
CONNER Asphalt Equip.
CHAIN BELT Concrete Mix-
ers, Saw Rigs, Pavers
HOVO Engines, Hoists,
Pumps
WYOMING Shovels, Picks

SAUERMAN Cableways
"RED STAR" Wheelbarrows
BATES Wire Ties
FULSOMETER Steam
Pumps
PATENT Safety Swingline
Beafielding
TRU-LAY Wire Rope
BUFFALO-SPRINGFIELD
Road Builders
SULLIVAN Compressors
PORTABLE Conveyors
ETNYRE Asphalt Distrs.
FLYNN Surrider

Member: Associated Equipment Distributors

PHILLIPS MACHINERY CO.

900 East Cary St. Richmond, Va.

Representing

Austin Machinery Corp.
Clyde Sales Co.
Chicago Automatic Conveyor Co.
DeWalt Products Corp.
Erie Steel Construction Co.
Jackson Mfg. Co.
Sauerman Brothers, Inc.
Chicago Pneumatic Tool Co.
Stephens-Adams Mfg. Co.
Rogers Brothers Corp.
General Excavator Co.
Aeroll Burner Co.
Manitowoc Engineering Works
Broderick & Bascom Rope Co.
Chain Belt Company
Van Dorn Electric Tool Co.
Also many other lines of Contractors' Equipment
Member: Associated Equipment Distributors

PACIFIC HOIST & DERRICK CO.

Machinery and Equipment

3200 4th St. Seattle, Wash

Representing

NORTHWEST—Gas and Electric Shovels,
Cranes and Draglines
BUHL—Air Compressors
TWIN DISC—Clutches for all purposes
PAGE—Scraper Buckets, Diesel Draglines
MINNEAPOLIS—"Twin City" Gas Engines
CLIMAX—Gasoline Engines
WISCONSIN—Gasoline Engines
MARMON-HERRINGTON—Trucks
DAKE ENGINE CO.
PIONEER—Gravel Equipment
ISAACSON IRON WORKS—Buckets
CLETRAC—Tractors

Member: Associated Equipment Distributors

CONSTRUCTION EQUIPMENT CO.

1118-1124 Ide Ave., Spokane, Wash.

Aeroll Burner Co.
Archer Iron Works
Bebe Bros.
Blystone Mfg. Co.
Broderick & Bascom Rope
Co.
Buffalo-Spghd. Roller Co.
Butler Bin Co.
Chain Belt Co.
Climax Eng. Co.
D-A Lubricant Co.
Detroit Graphite Co.
DeWalt Products Co.
Elgin Sales Corp.
Fairbanks, Morse & Co.
Fairbanks-Health Co.
Garco Manufacturing Co.
Homestead Valve Mfg. Co.
Kalamazoo Ry. Supply Co.

LeRoi Co.
Linde Air Products Co.
N. & M. Wire Clamp Co.
Niagara Mfg. Co.
Novo Engine Co.
Oakshoe Motor Truck Co.
Bates Valve Bag Corp. (Wire
Ties)
Saugen Derrick Co.
Sheldon Mfg. Co.
Sterling Wheelbarrow Co.
Sullivan Machinery Co.
Sunbeam Mfg. Co.
Templeton, Kenly & Co.
Thaw Shovel Co.
Williamette-Health Co.
"Williams" Buckets &
Trailers
Young Iron Works

Member: Associated Equipment Distributors

BOEHCK EQUIPMENT CO.

2404 W. Clybourn St. Milwaukee, Wis.

Representing

Barber-Greene Co.
Jaeger Machine Co.
Lakewood Engineering Co.
LeRoi Co.
A. Leach & Sons Rope Co.
Wellman Engineering Co.
W. Toepfer & Sons Co.
Hetzl Steel Form & Iron
Co.
Flexible Road Joint Mach.
Co.
McKernan-Terry Co.
Homestead Valve Mfg. Co.
Saugen Derrick Co.

American Hoist & Derrick
Co.
Richmond Screw Anchor Co.
Trackson Co.
Jones-Superior Machine Co.
Fairbanks, Morse & Co.
Youngstown Pressed Steel
Co.
Independent Pneumatic Tool
Co.
Gibson Tool Co.
Production Equipment Co.
Hetherington & Benser Co.
Inc.

Member: Associated Equipment Distributors

DROTT TRACTOR CO., Inc.

3841 W. Wisconsin Ave.

Milwaukee Wisconsin

Representing

ALLIS-CHALMERS Trac-
tors, Graders, Speed Pa-
trollers, Hauling and Power
Units
OSKOSH 4-wheel Drive
Trucks
PIONEER Gravel Equip-
ment
WAUSAU Snow Plows
DROTT Bulldozers, Scrap-
ers, Scarifiers, etc.

KINNEY Road Oilers
HAUCK Kettles, Heaters
LACROSSE Trailers
KOB Sand Spreaders
TORKHOFF Highways Mow-
ers
HERCULES Road Rollers
DAVEY Air Compressors
Eveland Road Machy. Co.
WAUKESHA Power Units
TIMKEN Roller Bearings

Member: Associated Equipment Distributors

HUNTER TRACTOR & MACHY. CO.

Phone: Orchard-6580

327 So. 16th St. Milwaukee, Wis.

Representing

Aeroll Burner Co.
American Steel & Wire Co.
Archer Iron Works
Atlas Conveyor Co.
Bates Wire Ties
Blaw-Knox Co.
Bucyrus-Erie Co.
Buffalo-Springfield Co.
Burch Corp.
Chain Belt Co.
Clyde Iron Works
Eveland Road Machy. Co.
Iowa Mfg. Co.
Killefer Mfg. Corp., Ltd.

Lynn Iron Works
McKernan-Terry Corp.
Pacific Marine Supply Co.
Pulsometer Steam Pump Co.
R. B. Mfg. Co.
Saugen Derrick Co.
Sawman Bros.
Sterling Wheelbarrow Co.
Sullivan Machy. Co.
Syston Co.
Toledo Pressed Steel Co.
Universal Form Clamp Co.
Winlow Gw't St. Scale
Wks.

Member: Associated Equipment Distributors

JUST EQUIPMENT & SUPPLY CO., Ltd.

173 Colborne Street Montreal, Que., Canada

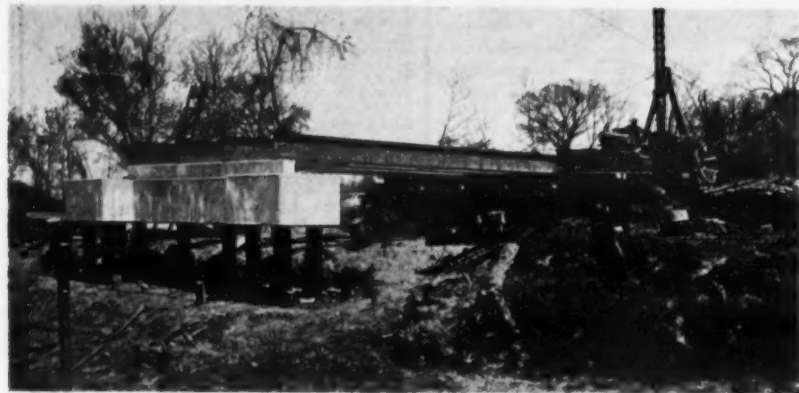
Athey Truss Wheel Co.
Buffalo-Springfield Roller
Co.
Caterpillar Tractor Co.
E. B. Elmyr & Company
All Steel Products Mfg. Co.
LaPlant-Choate Mfg. Co.
National Steel Car Corp.,
Ltd.
National Equipment Corp.
Kochring Div., Parsons
Div., Kwik-Mix Div.
Scheram, Inc.
Sterling Machinery Corp.
The Byers Machine Co.
Killefer Mfg. Co.

Detroit Harvester Co.
Brookville Locomotive Co.
The W. K. M. Company
The Buda Company
Pioneer Gravel Eq. Mfg. Co.
Contractors Mach. Corp.
Blaw-Knox Company
Insley Manufacturing Co.
Eveland Road Machy. Co.
C. H. & E. Mfg. Co.
Ward Plev Company
Wood Hydr. Hoist & Body
Co.
R. G. LeTourneau, Inc.
The Anthony Co., Inc.
Williamette-Hyster Co.

Contractors and Engineers Monthly



Snow! And Then Some. Fillmore County, Nebr., Fought the Drifts Successfully, Breaking Through As Much As 8 Feet of Hard-Packed Snow to Clear Its Roads. See Page 27.

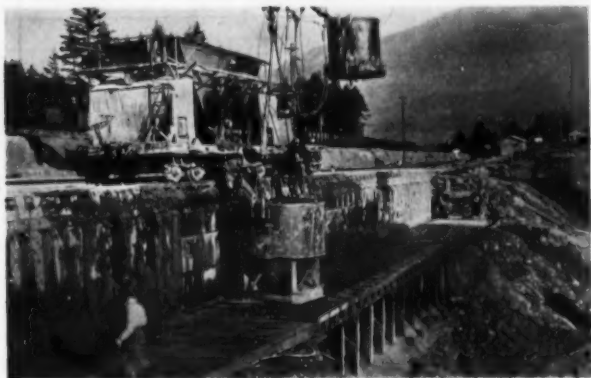


C. & E. M. Photo

Sni-a-Bar Creek Is Bridged with This Typical Farm-to-Market Bridge in Western Missouri. See Page 2.

E. J. Callahan, Supt. for G. G. Herrick, Built This Iowa Road from Scratch with a Green Organization. See Page 1.

C. & E. M. Photos



Concrete for Bonneville Spillway Is Handled in a Novel Manner by a Third-Rail Hopper Car and Hi-Line Bucket. See Page 2.



Wide World Photo

One of the Spans of the Richmond, Maine, Bridge Goes Down with the Flood of the Kennebec River. This Is Only One of Hundreds of Damaged Structures in the Flood Areas Which Must Be Replaced.



"The Covered Wagons" of a Wisconsin Contractor Temporarily Encamped Near His 4.6-Mile Grading Job. See Page 29.



An Electric Arc Puts the Finishing Touches on the Hard Rail of the Lorain Road Bridge. See Page 36.



Another Florida Boom? One of the Outfits Moving Dirt on Florida's Cross-State Canal. See Page 28.